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Air Brake Catechism

And Instruction Book on the Construction and Operation of the Westinghouse and New York Air Brakes with a List of Examination Questions and Answers for Enginemen and Trainmen. . . . . .

BY

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INTRODUCTION.

In this enlarged edition of the Air Brake Catechism, the latest equipment of the New York Air Brake Company is fully illustrated and explained. The author wishes to say he regrets the same could not be done with the Westinghouse Brake; however, on account of the limited size of the book, both brakes could not be treated fully, and feeling that the New York brake was the later one in the field, and therefore, perhaps less understood, more space was given it. But, as the book includes a general discussion of both brakes, the troubles and peculiarities of each will be found to be duly explained. While the questions and answers are divided for Enginemen and Trainmen, both should consult each other's parts, and thereby become familiar with all the equipment.

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DUPLEX AIR PUMPS.

The Duplex Air Pumps manufactured by The New York Air Brake Company are of four different sizes, and are known as the Nos. 1, 2, 5 and 6. The dimensions of these pumps are as follows :

Pump No.	Diameter of Steam Cyl.	Diameter of L. P. Air Cyl.	Diameter of H. P. Air Cyl.	Stroke
1	5 in.	7 in.	5 in.	9 "
2	7 "	10 "	7 "	9 in.
5	8 "	12 "	8 "	12 "
6	7 "	11 "	7 "	10 "

The No. 1 and No. 2 differ somewhat from the No. 5 and No. 6 in design as well as in size, although the principle of operation is practically the same.

The valve gear of the duplex air pump is exceedingly simple, consisting of two ordinary D slide valves, actuated by valve stems which extend into the hollow piston rods and are moved by contact with the tappet plates bolted on the steam piston heads. The valve on one side controls the admission of steam to, and exhaust from the opposite cylinder, as shown, so that while one of the pistons is moving the other is at rest.

The air cylinders are known as the low pressure and high pressure cylinders, and in each type of pump, the difference in the areas of the air cylinders is in the same proportion, the low pressure piston having twice the area of the high, and the high pressure the same area as the steam cylinders. Thus three measures of air are compressed with two measures of steam.

The operation of all the duplex air pumps is practically the same, the difference being in the arrangement of the air valves. The No. 1 and No. 2 have six air valves, viz., upper and lower receiving, upper and lower intermediate and upper and lower discharge valves, and the same air inlets for both cylinders. The No. 5 and No. 6 have separate air inlets for each cylinder and eight air valves, viz., upper and lower receiving for low pressure cylinder, upper and lower intermediate, upper and lower receiving for high pressure cylinder and upper and lower discharge. All air valves of the No. 5 pump are the same size and are interchangeable. This is also the case with those of the No. 6.

The No. 5 and No. 6 pumps are identical except in size, and as this type of pump is the later one, we will describe the operation of the No. 5.

By referring to the plates Nos. 1, 2, 3 and 4, it will be seen that each part has a reference letter and the pump pistons are shown in different positions. We will use these letters in the description of the operation, so that the movements can be easily followed, by referring to the plates when reading the explanation.

OPERATION.

Before the pump has been started, both pistons will naturally be at the bottom of the cylinders, due to their own weight, or, if not completely down, will at least have dropped enough to permit the slide valves to fall to the bottom of the steam chests.

Assuming that the pistons are both down, when the pump throttle is opened live steam flows into both steam chests B, and is always present in them when the pump is taking steam. In this instance only, steam is admitted to both cylinders at once, through port g, to the upper side of piston H, which being at the bottom is merely held in that position, and through port o, to the under side of piston T, (Plate 1). Piston T now moves upward and in doing so forces the air that is above the piston in low pressure cylinder D, through intermediate valve K, into the high pressure cylinder F. At the same time, the low pressure piston tends to create under it a vacuum, which is filled with air at atmospheric pressure through the air inlet at the right, and receiving valve W. Just before piston T reaches the end of its upward stroke, the tappet plate Q engages the button on the end of the valve stem P, which moves the slide valve C, to its highest position, allowing the steam above piston H, to pass through ports g, cavity r, in slide valve C, and the exhaust X, to the atmosphere, and live steam through port s, to the under side of piston H. As piston H moves upward (Plate 2), the high pressure piston in cylinder F forces the air above it, which may be said to be under the first stage of compression, through discharge valve M, to the main reservoir, while its upward movement tends to create a vacuum under it in the high pressure cylinder F, which is

filled with air at atmospheric pressure through high pressure receiving valve N.

Just before piston H completes its upward stroke (Plate 3), tappet plate L, engages with the button on the valve stem, raising it with the slide valve A, exhausting the steam under piston T, through port o, cavity r, in slide valve A and the exhaust X to the atmosphere, and admitting steam through ports v to the upper side of piston T, moving it downward. During the downward movement of piston T, the low pressure piston in cylinder D forces the air under it which was taken in on its upward stroke through the intermediate valve E to the under side of the piston in high pressure cylinder F, and at the same time cylinder D is filled with air at atmospheric pressure through the air inlet and upper receiving valve U. Just before the piston T completes its downward stroke (Plate 4), the tappet plate Q, coming in contact with the lower tappet or shoulder on the valve stem P, moves the slide valve C to its lowest position, allowing the steam under the piston H to exhaust to the atmosphere through port s, cavity r, in slide valve C and the exhaust X, and admitting live steam to the upper side of piston H, through port g, moving it downward. As piston H moves downward, the high pressure piston forces the air under it through the lower discharge valve I into the main reservoir, while the cylinder is filled above with air at atmospheric pressure through the air inlet at the left, and receiving valve J.

The completion of this stroke completes one cycle of the pump. The movements described are repeated through each succeeding cycle.

Before starting a pump, open the drain cocks

in the steam and exhaust passages. Then the steam valve slightly at first, and run the pump very slowly until all the condensation has been worked out of the steam cylinders. Then the steam valve may be opened a little more, but the pump should be run slowly until a pressure of 50 or 60 pounds has been accumulated in the main reservoir. It should be run just fast enough to promptly restore the pressure in brake system, but never raced.

The lubricator should feed about twenty drops of oil rapidly to steam cylinder, after drain cocks are closed, then cut down to about one drop per minute. Keep all joints between the lubricator and pump perfectly tight, so that no oil will be wasted. Oil can leak away at the steam joints where there is little or no indication of steam leakage. The piston rods should be kept well packed and swabs, well oiled, should be maintained on them.

AIR PUMP DISORDERS.

Broken or stuck air valves or seats will materially reduce the efficiency of the pump, and cause it to work unevenly, and can usually be located by watching the action of the pistons, which will move quickly toward a leaky receiving valve and slowly toward a leaky discharge valve. A leaky receiving valve is also indicated by air blowing back by the valve, as the piston moves toward it, but as one inlet supplies both ends of the cylinder, this air, instead of passing out to the atmosphere will usually go in with the incoming air to the other end of the cylinder. Therefore, to test for a leaky receiving valve, run the pump slowly, and hold the hand over the air inlet; the suction will be less on the stroke toward the leaky valve, also quicker

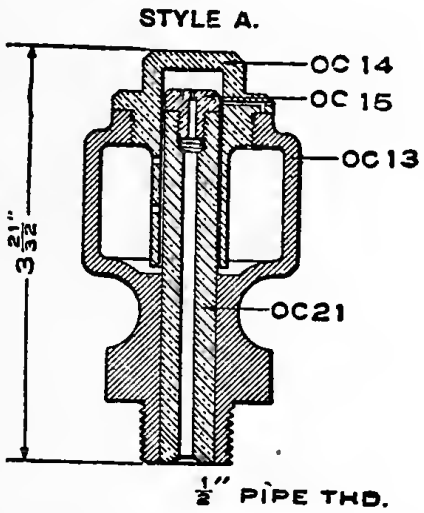
than the one from it. To test for a leaky upper intermediate discharge valve, run the pump slowly and as the high-pressure piston moves up, remove the low-pressure cylinder oil cup; a blow here during the up-stroke indicates a leaky valve. To test the final discharge valves, pump up about 90 pounds pressure, and stop the pump, with both pistons at the bottom of the cylinders, open the drain cocks, and allow all steam to escape. Remove the high-pressure cylinder oil cup. If a steady blow occurs, and the piston remains down, the upper valve is leaking; if no blow occurs and the piston moves up, the lower valve is leaking. Leaking piston packing rings will also greatly reduce the capacity of the pump. To detect them: After the pressure is pumped up, stop the pump and remove the oil cup. If no blow occurs, it proves the discharge valves are tight. Start the pump again, and note if there is a blow on the down stroke; if so, the packing rings are leaking.

Should the pump stop and refuse to go to work again, first see that the governor is working properly, and that the pump is getting a full supply of steam, by opening the drain cock in the steam passage (see governor disorders). Sometimes a pump will stop on account of insufficient lubrication, and may be started by shutting off the steam for a few moments, opening the drain cock in the steam passage and again turning on the steam, letting the lubricator feed a few extra drops of oil. If it will not then go to work, it will undoubtedly be due to a break down, which would have to be repaired in the shop.

THE AUTOMATIC OIL CUP.

The principle of operation of the automatic oil cup is as follows:

As the air piston makes its up-stroke, compressed air is driven upward through the passage drilled through the center post in the body of the oil cup, next passes downward inside the extended sleeve of the cap nut, and then through the regulating ports drilled in this sleeve, to the surface of the oil in the cup, on which it creates pressure. As the air piston makes its down-stroke, a vacuum is formed in the passage in the center post, and also inside



the extended sleeve of the cap nut which envelopes the center post, and the air pressure on the surface of the oil, formed when the air piston made its up-stroke, on the down-stroke forces the oil to the inside of the sleeve, and a small portion of it is drawn into the air cylinder through the hole in the feed cap.

This cup should be filled before starting on a trip. Use only good cylinder oil to fill it, as other oils do not lubricate air cylinders on account of their low flash point. Never oil through

the air inlets, as it clogs the passages and valves. The automatic cup can be filled whether the pump is running or not, and it is a good plan to start the pump first, so as to be sure that the small port in the feed cap, OC15, is open. Be careful not to enlarge it when cleaning it out.

PUMP GOVERNORS.

The function of the pump governor is to stop the pump when the desired air pressure has been obtained, and to again allow steam to be admitted to the pump when this pressure has been slightly reduced, thus practically maintaining a constant pressure.

The pump governor is shown with the steam valve open (in Fig. 5) and with it closed (in Fig. 6), and the arrows indicate the direction of flow of steam and of air.

OPERATION.

When sufficient air pressure, the amount for which the governor is adjusted, accumulates in the diaphragm air valve chamber to overcome the resistance of the regulating spring, the diaphragm air valve PG 13 is lifted, uncovering the air passage in its seat PG 14, and air flows down on top of piston PG 4, which rests on top of steam valve PG 5. Then the piston and steam valve together are forced downward until the latter seats as shown in Fig. 6, and closes the steam passage leading to the air pump, thus cutting off the supply of steam.

When the air pressure in the diaphragm air chamber falls below the tension of the regulating spring, diaphragm air valve PG 13 seats, as shown in Fig. 5, and cuts off the flow of air to the governor piston PG 4. The remaining air

pressure in the governor piston chamber is quickly reduced on account of the air escaping from this chamber through small vent port, indicated by the small dotted circles, in the air passage connecting the diaphragm air valve and the goverror piston air chambers; then the steam pressure acting upwardly on the face of the steam valve PG 5 forces this valve open and admits steam to the pump.

ADJUSTING.

The pump governor is adjusted to regulate the amount of air pressure carried, by means of the regulating spring.

Increasing the tension of the spring increases the air pressure that may be carried, and decreasing the tension decreases the air pressure.

When adjusting the pump governor, beginning with the main reservoir pressure top, observe the following:

Place the brake valve handle on lap and adjust the main reservoir pressure top.

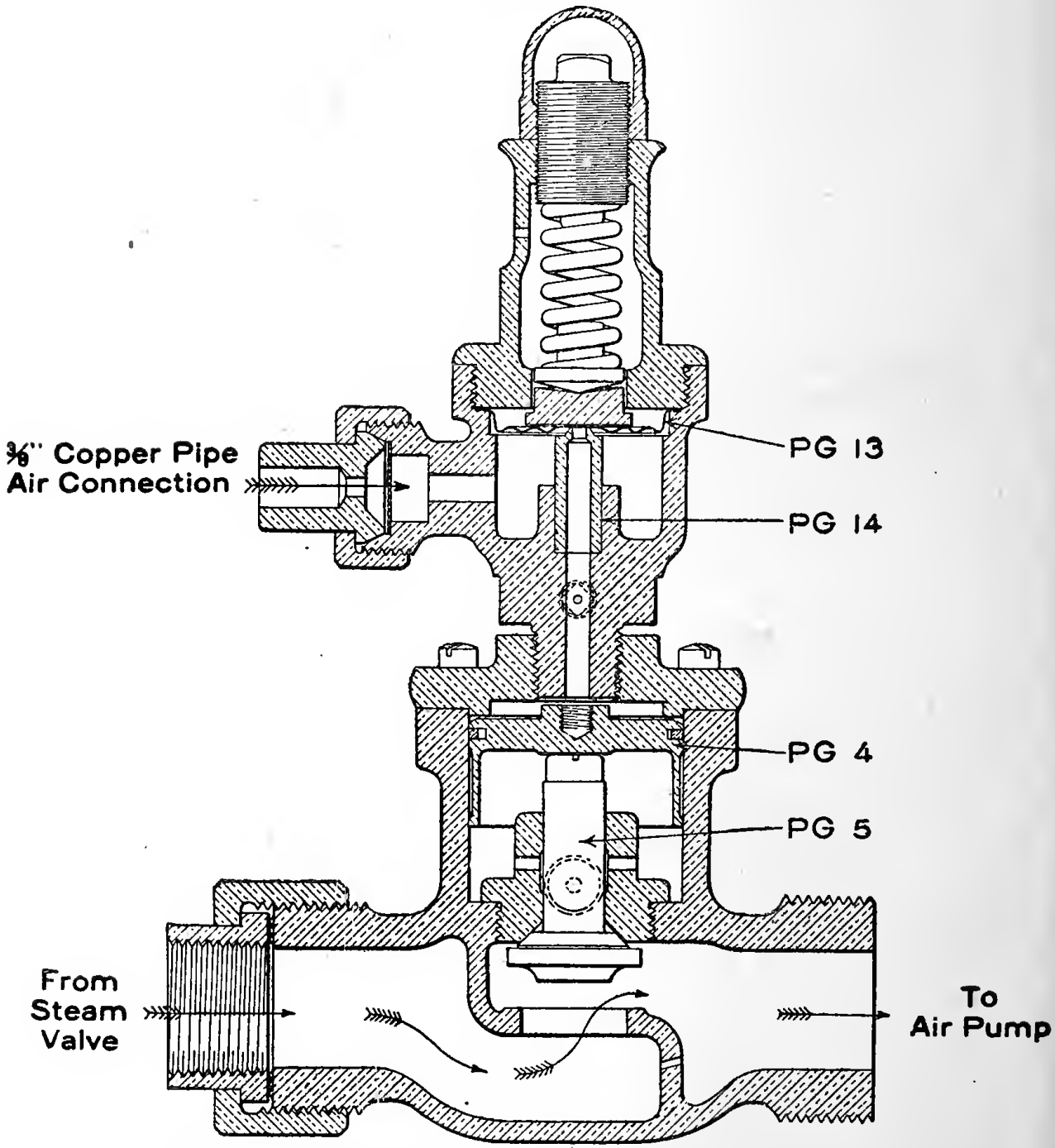
Then stop the pump and reduce the main reservoir pressure to about 60 pounds. Start the pump.

Place the brake valve handle in release position and adjust the brake pipe low pressure top; then cut out the low pressure top and adjust the brake pipe high pressure top.

Screw down the adjusting nut until the pump stops at the desired pressure, and note the promptness with which it starts when the air pressure reduces slightly, screwing down adjusting nut a trifle if the pump does not start promptly, after which replace cap nut securely.

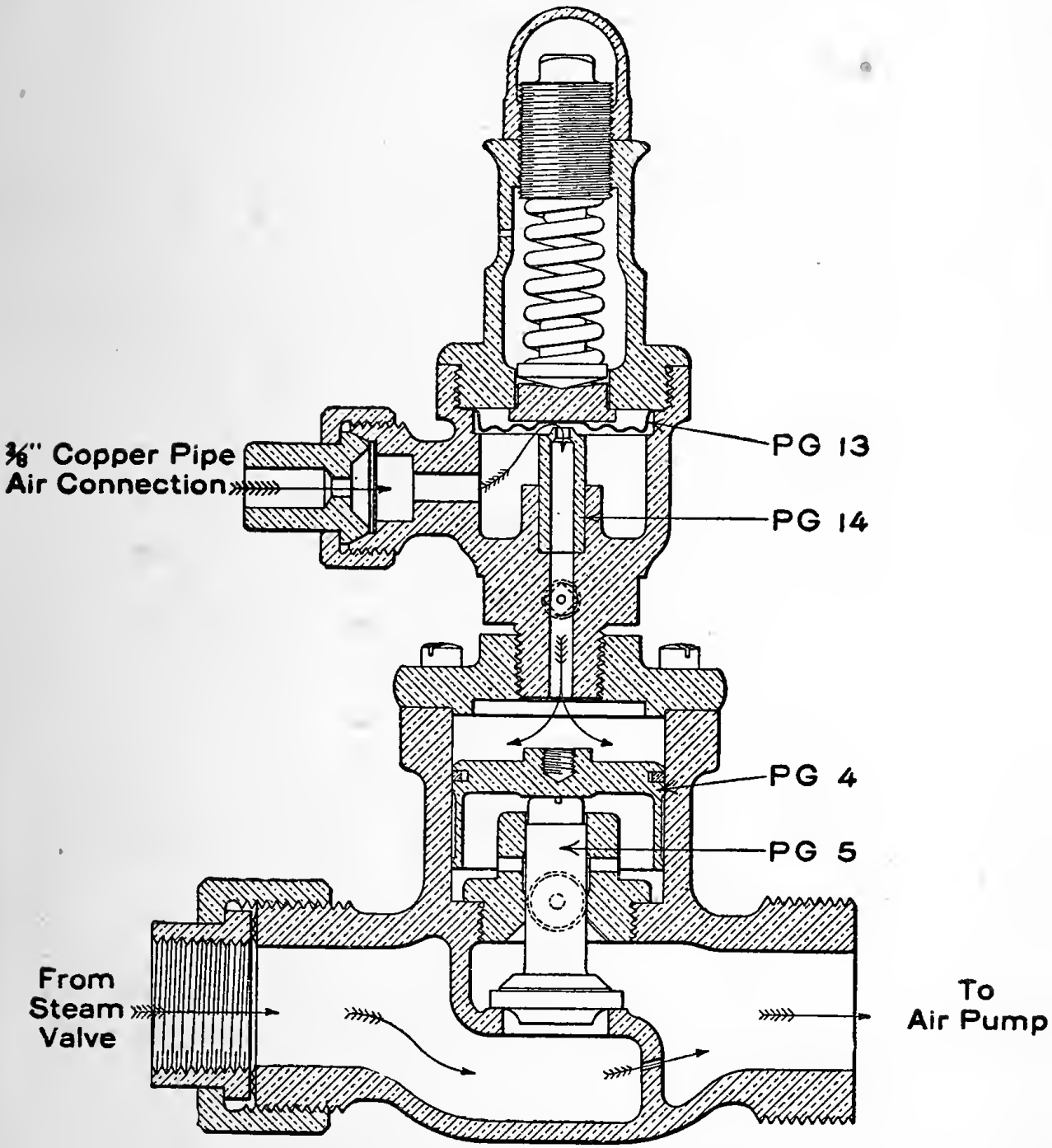
When adjusting governors, be sure that the air gage is correct.

Fig. 5.



Pump Governor. Steam Valve Open.

Fig. 6.



Pump Governor. Steam Valve Closed and Air Passing to Top of Piston PG 4.

PUMP GOVERNOR DISORDERS.

When the governor stops the pump, and does not permit it to go to work promptly upon a slight reduction in air pressure, it is probable that the diaphragm valve is leaking. This leakage tends to hold the steam valve closed, and make the pump work slower than before. The leakage past the diaphragm can be detected by the constant flow of air from the small relief port (small dotted circle) in the diaphragm body.

When the pump has been working properly but begins to run slower each day, of its own accord, it is an indication that there is an accumulation of lime or other matter on the stem of the steam valve PG 5, which reduces the lift of that valve and makes it throttle the pump.

When the governor fails to stop the pump, and the standard pressure has been accumulated, assuming, of course, that it has been properly adjusted, it is probable that the relief, or drainage, port (indicated by the larger dotted circles) in the governor body is stopped up. This port is for the relief of any steam or air leakage that might occur into the chamber below the governor piston and from a pressure under it. When the relief port is blocked up—the leakage into this chamber is trapped and forms a pressure underneath the governor piston that will be greater than the air pressure coming in on top of this piston, hence the governor can not operate to close the steam valve, and the pump will run uncontrolled.

When a waste pipe is screwed into this port it should be very short.

Should the diaphragm air valve leak around the edges into the spring case and at the same time the small relief port in this case should happen to be stopped up, the governor would allow the pump to run uncontrolled. The same would be true if the air passage through seat PG 14 should become blocked up solid with gum.

In all cases where the pump stops and refuses to go to work, before doing anything else, examine all relief ports in the governor, and see that they are perfectly free. Open the drain cock in the steam passage of the steam head of the pump and note whether or not steam is passing freely to the pump.

If not, tap the governor on the bottom, as the steam valve may be stuck shut.

NEW YORK ENGINEER'S AUTOMATIC BRAKE VALVE, STYLE B1.

THE PRINCIPAL PARTS AND THEIR DUTIES.

Referring to Fig. 7 the main reservoir supply pipe is connected to chamber B. The brake pipe is connected to chamber A. Discharge of brake pipe air to the atmosphere, for service application, occurs through ports F and G, in the main slide valve, and exhaust port C, in the slide valve seat, when the handle is placed in the service graduating notch; and for emergency applications, through ports J and K, in the main slide valve, and exhaust port C in the seat. The Main Slide Valve also controls the flow of air from the main reservoir into the brake pipe.

Small slide valve EV 110 is a cut-off or graduating valve, operated by piston EV 104A and lever EV 112. In service applications it automatically laps port F and stops the discharge of brake pipe air, when the brake pipe reduction, corresponding to the service graduating notch in which the handle is placed, has been made.

Piston EV 104A, which is exposed on one side to brake pipe pressure, Chamber A, and on the

other to Chamber D and supplementary reservoir pressure, through the agency of lever EV 112 causes valve EV 110 to move automatically whatever distance is necessary to close port F. Reducing brake pipe pressure (chamber A) by placing the handle in the service application position causes ball check EV 184 to seat and prevent the backward flow of air from chamber D to chamber A through piston EV 104A.

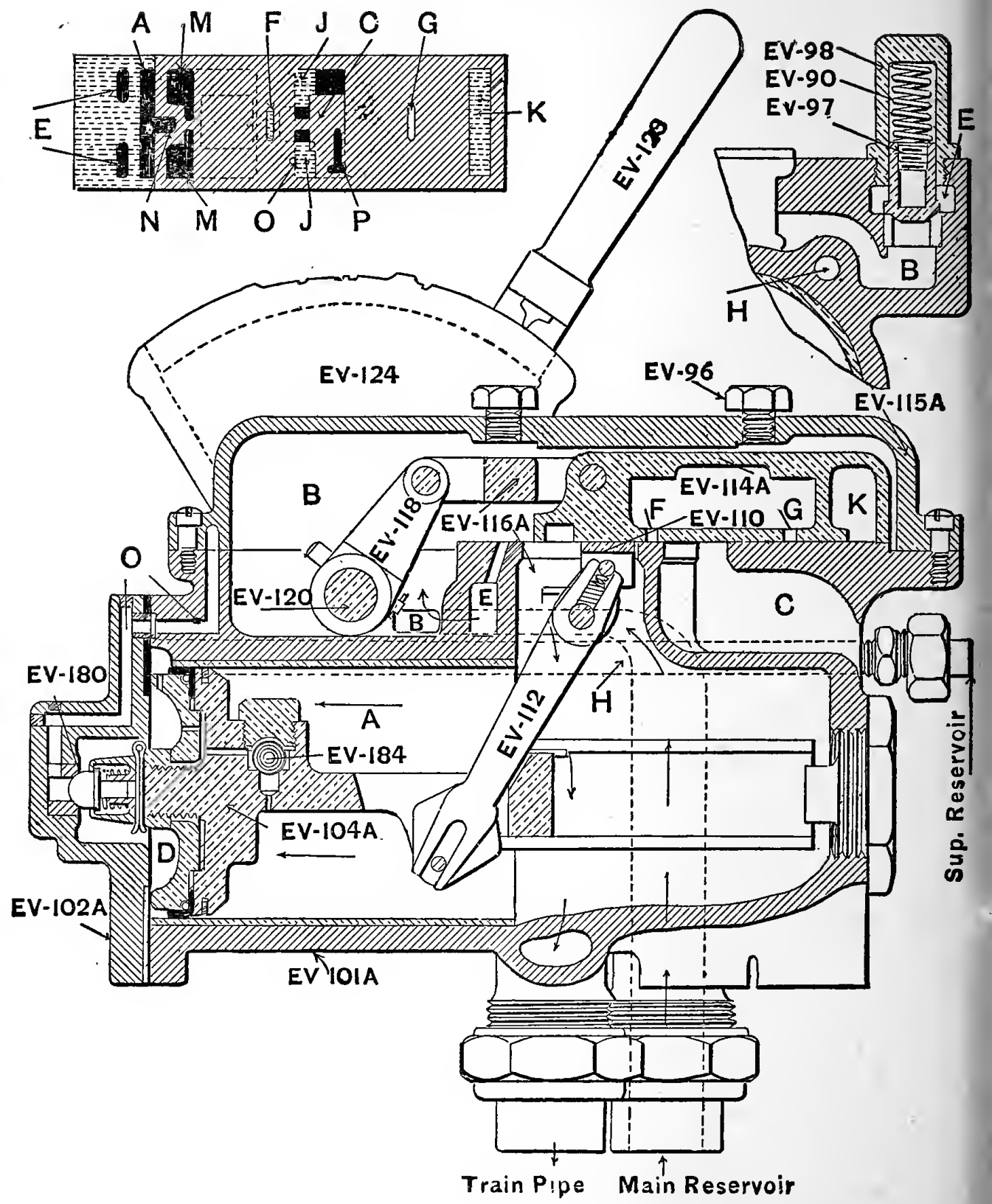
The supplementary reservoir pressure, therefore, will push piston EV 104A forward, and move the small slide valve EV 110 as far to the left as the main slide valve was carried to the left, or until it closes port F.

Passage "H" runs lengthwise of the valve, one end leading to the supplementary reservoir, the purpose of which is to enlarge chamber "'D" back of piston "EV-104-A." In the Release and the Running position air from chamber "A" passes through piston "EV-104-A" to chamber D, thence through passage H to the supplementary reservoir until there is equal pressure on both sides of this piston, and the supplementary reservoir pressure is equal to the brake pipe pressure.

OPERATION.

The operation of the valve will be easily understood from Figs. 7, 8, 9, 10, 11 and 12,which show the various internal arrangements of valves and ports for each position of the brake valve handle.

Fig. 7.—Release.



RELEASE.

In this position air is flowing direct from chamber B (main reservoir) into chamber A (brake pipe) past the end of valve EV 114A, through the large opening in the valve seat. This causes the brake pipe pressure to increase rapidly, and force the triple valves to release position.

Equalizing piston EV 104A and small cut off valve EV 110 are also returned to their normal positions, as shown, ready for another application.

When the handle is placed in release, a light puff of air will be heard at exhaust port C. This is air escaping from chamber D, through port O, which will reduce chamber D pressure sufficiently to allow piston EV 104A to return to its normal position and seat check valve EV180, this check valve closing port O, and preventing further escape of chamber D air. Chamber D and the supplementary reservoir are charged as soon as check valve EV 180 seats, through ball check EV 184.

This is also true when the handle is returned from the application position to lap or to running position.

USE OF RELEASE POSITION.

When releasing brakes it is very important, unless the train be unusually short, that the handle be placed in " release " as shown in Fig. 7, and allowed to remain there until the red and the black hand, moving up together, reach the pressure for which the brake pipe pressure top of pump governor is adjusted, and the governor slows down the pump, then move the

handle to the running position, when the pump will accumulate the excess pressure.

The slowing down of the pump, when both gage hands are at the brake pipe pressure figure indicates that the auxiliaries are recharged.

When handled in this way, there is no danger of brakes "creeping on" on the front portion of the train during the time that the pump is accumulating sufficient excess pressure to lift the feed valve EV 97, and feed the brake pipe, while they are apt to do so if the handle is returned before the auxiliaries and brake pipe are fully recharged.

Cavity "N" in end of the slide valve, connects chambers "B" and "A" while handle is between release and running position, and thus prevents a false lap position. It may be utilized to good advantage when accumulating the excess pressure with a leaky brake pipe, by placing the handle about one half-inch from running position, until the excess pressure is pumped up. Then when the handle is moved to running position, the excess pressure valve will open.

When charging trains in yards and terminals, and when recharging auxiliaries while descending grades, carry the handle in release position.

Under the above conditions of charging and recharging, time is of much more consequence than excess.

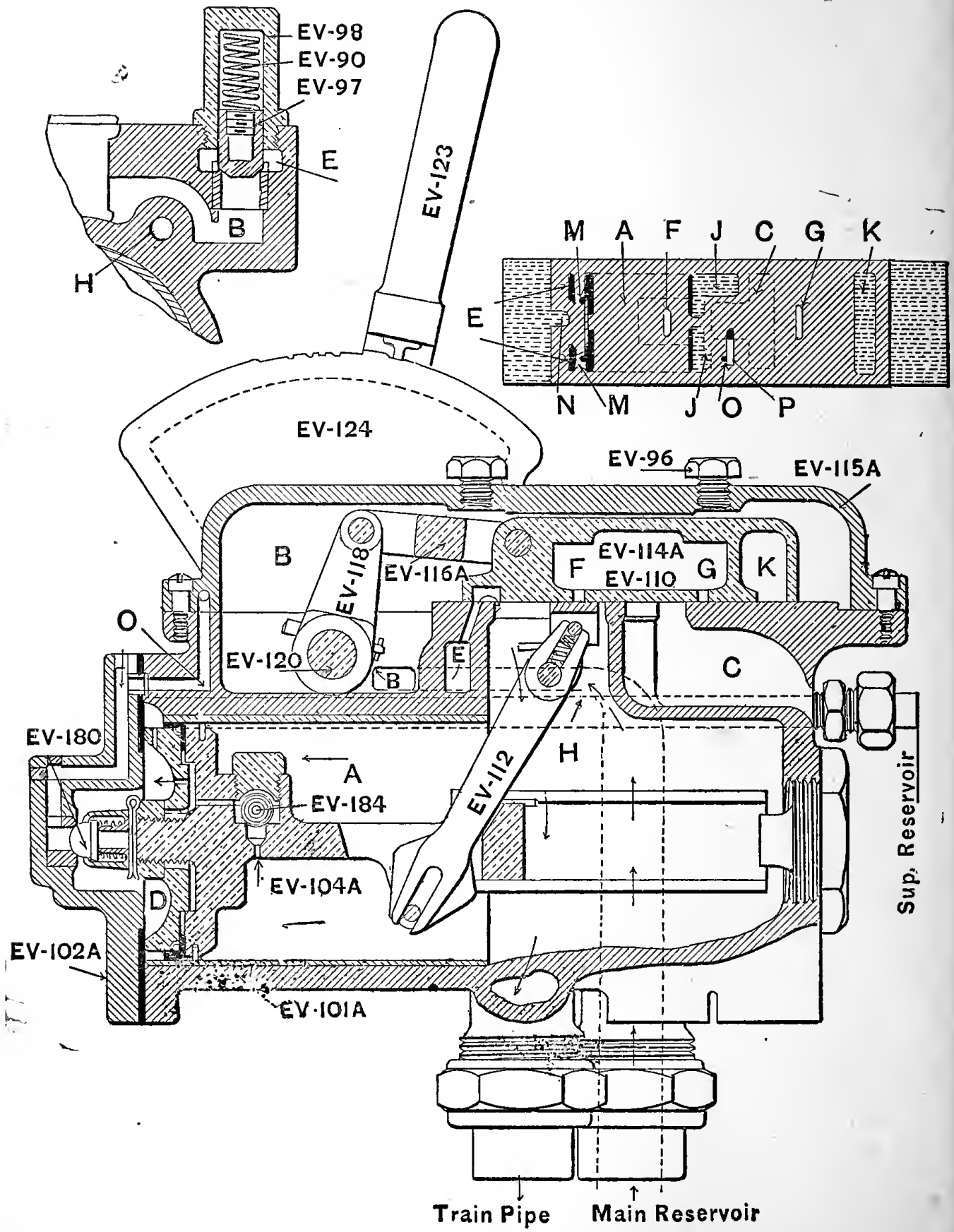
RUNNING POSITION.

In this position air from chamber B can not flow directly into chamber A, but must pass the

excess pressure, or the feed, valve, EV 97, before entering the brake pipe. The spring EV 90 has a tension sufficient to hold valve EV 97 on its seat against a pressure of 15 or 20 pounds, which ever amount of excess is carried, acting upwardly on it from chamber B.

Running position is used, while the brakes are released and train is running, to accumulate the excess pressure in the main reservoir. Should brakes commence to "creep" on the drivers and front cars shortly after moving the handle to running from release position, move the handle quickly to release and back to running again once or twice. While running along with all brakes properly released, do not practice moving the handle to release and then back to running as this will overcharge brake pipe, and surely cause the brakes to creep on.

Fig. 8.—Running.



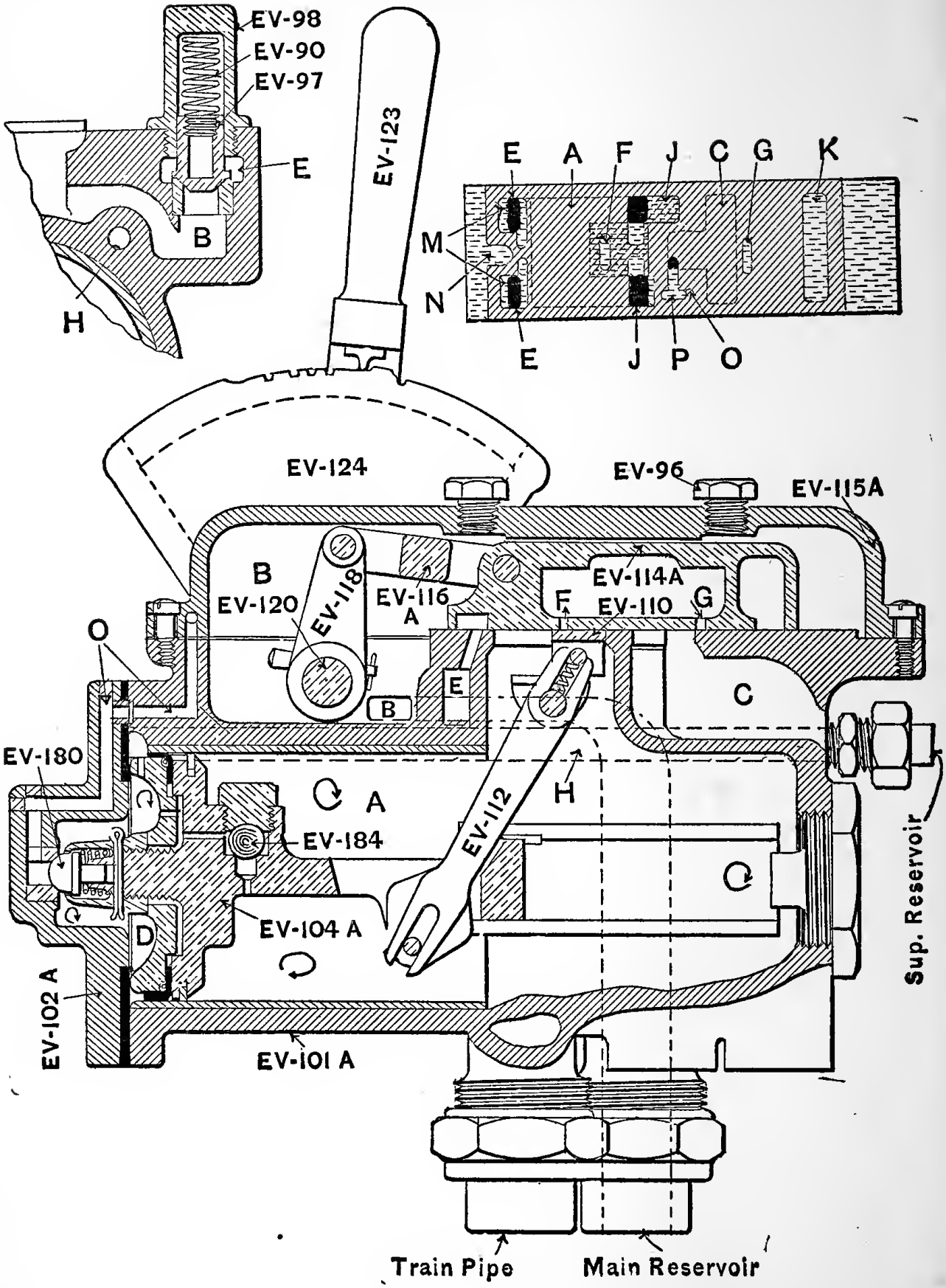
POSITIVE LAP POSITION.

In this position all communication between the main reservoir and the brake pipe, and between the brake pipe and the atmosphere, is closed. This position is used in making the two-application stop, to prevent over-charging of the brake pipe.

It is also used to test the main slide valve EV 114A, (see instructions on testing at page —, and, should the equalizing feature become inoperative, to cut-off the escape of brake pipe air when the required service reduction has been made, and hold the brakes applied.

Whenever the train parts or a hose bursts, handle should be placed in positive lap position, to save main reservoir air.

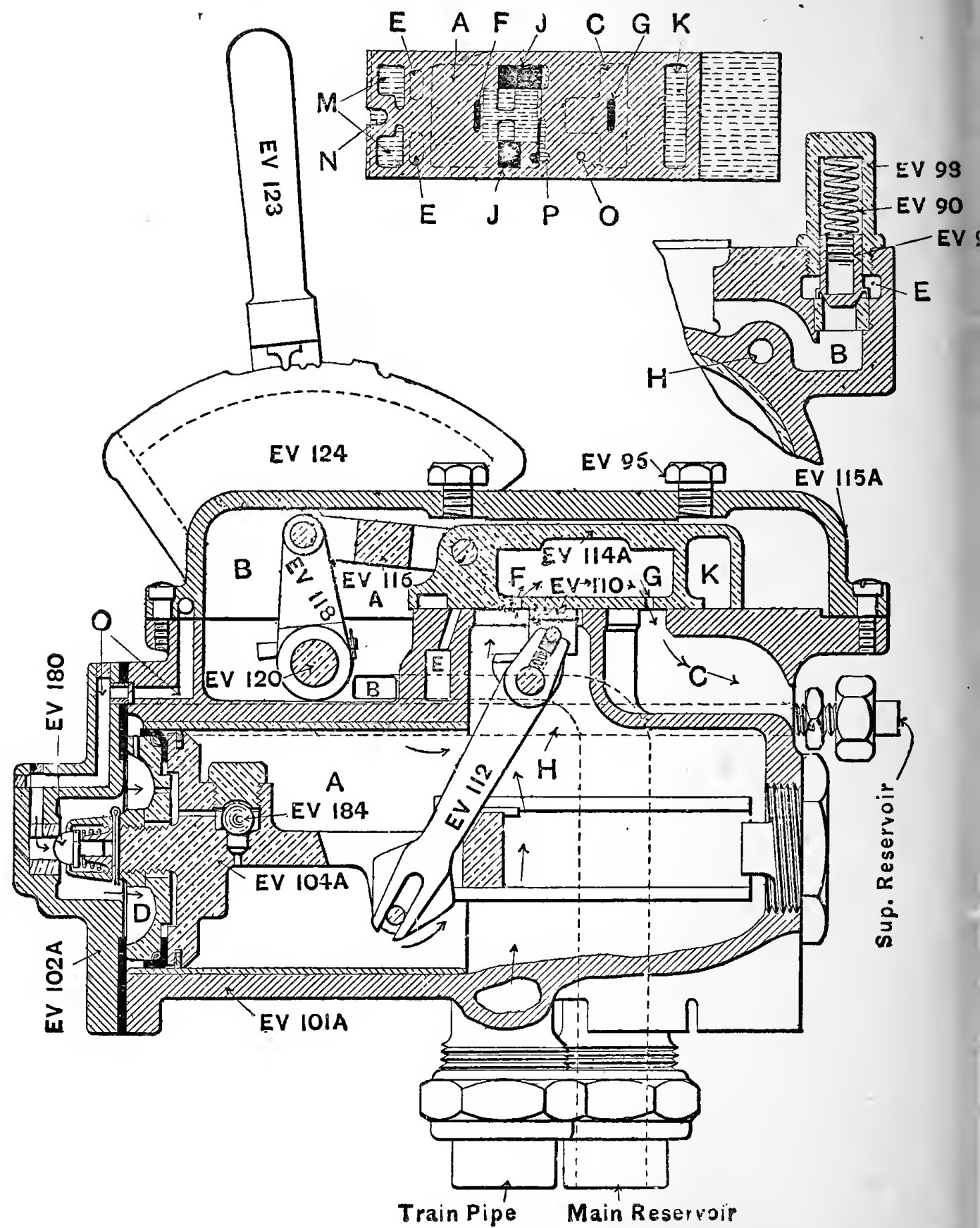
Fig. 9.—Positive Lap.



SERVICE GRADUATING POSITION.

In this position, ports "F" and "G" connect chamber "A" with exhaust port "C" and the atmosphere, so that the brake pipe air can escape gradually and cause the brakes to apply. Also port "O" in the slide valve seat is closed, so that pressure in supplementary reservoir and chamber "D" can force piston "EV-104-A" forward, and by means of lever "EV-112" move cut-off valve "EV-110" back to cover port "F," when the brake pipe reduction is made that corresponds to the service notch in which the handle is placed. Fig. 10 shows the handle in the third notch. The travel of piston "EV-104-A" is governed by the expansion of air in the supplementary reservoir and chamber "D"—the more air expands, the lower the pressure becomes. Therefore, supposing a reduction of eleven pounds be made in chamber "A" and the brake pipe, the piston moves to the right, allowing the air in chamber "D" to expand until it becomes reduced eleven pounds, when the piston will stop, as the pressure in chambers "D" and "A" are equal. Fig. 11.

Fig. 10.—Service Graduating.



Regardless of length of train the service graduating notches reduce brake pipe pressure as follows:

Brake Pipe Pressure	1st Ser. Grad. Notch	2d Ser. Grad. Notch
70 lbs.	5-5 lbs.	8-3 lbs.

3d Ser. Grad. Notch	4th Ser. Grad. Notch	5th Ser. Grad. Notch
11-3 lbs.	16-5 lbs.	23-7.

The first figure in the line of notch reductions denotes the total reduction had when handle is placed in that notch; the second figures denote the reduction for that notch if handle is moved along successively from the first to the last notch, and the valve is allowed to lap automatically in each notch. The brakes are fully applied in service when the last graduating notch is used.

When the train consists of 5 or more cars the first graduating notch should not be used to make the initial service reduction; if less than 5 cars, the first service graduating notch should be used for the initial reduction.

When the train is very short, if the second graduating notch is used to make the initial reduction, there is danger of the triple valves applying in quick action, because of the small brake pipe volume to draw from.

AUTOMATIC LAP POSITION.

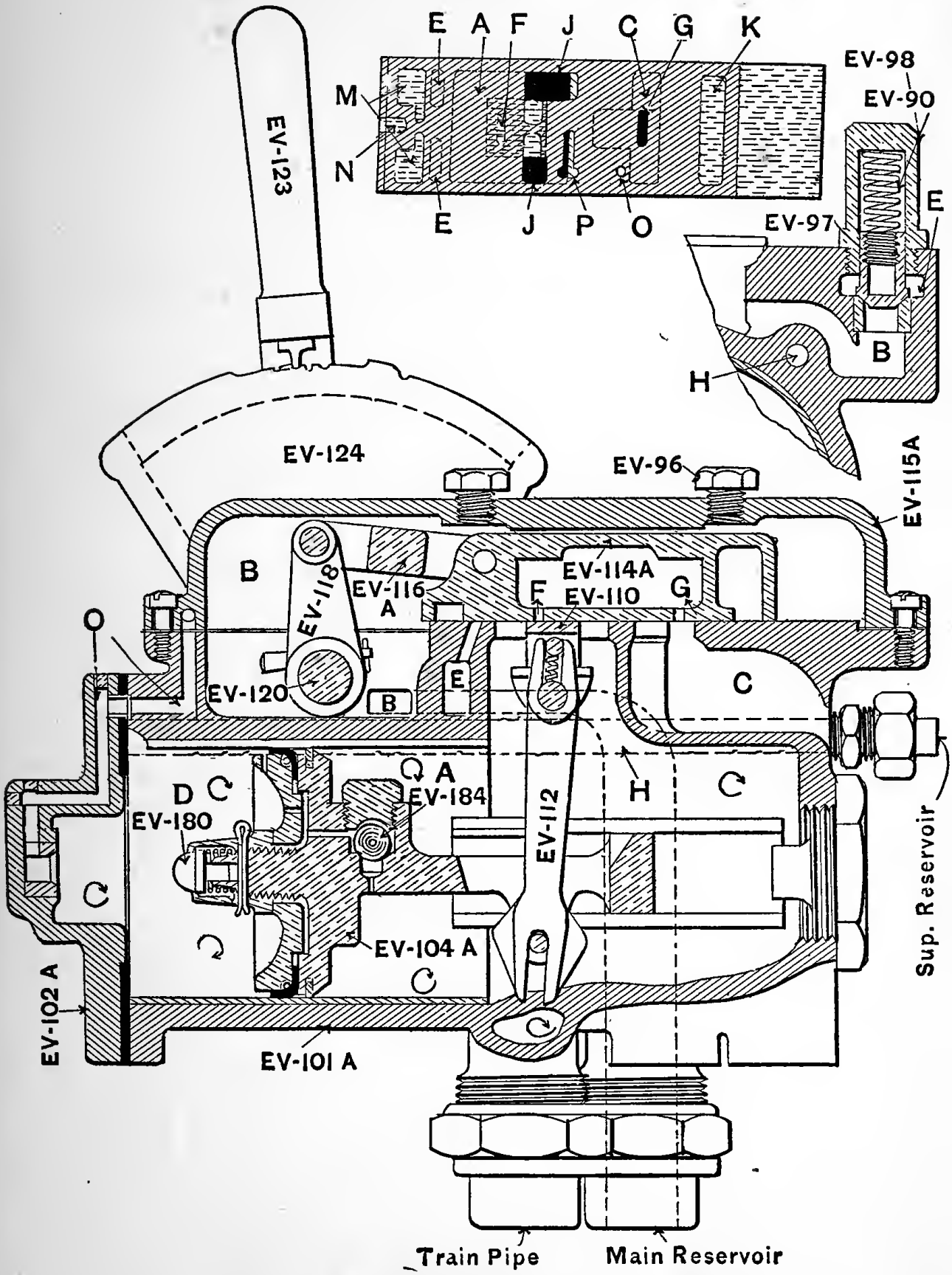
In this position cut off valve EV 110 has covered port F and stopped the escape of brake pipe air, and Fig. 11 shows the equalizing piston EV 104A moving forward and cut-off valve EV 110 closing port F, the service exhaust port.

To make a further service reduction in brake pipe pressure the handle must be moved into the next service graduating notch.

Should it happen that the automatic lapping feature did not operate perfectly, when making a service reduction,but instead allows the brake pipe exhaust to drag, move the handle forward slowly a short distance, or until the exhaust ceases.

If the pipe connecting the supplementary reservoir to the brake valve should become broken or disconnected, plug the connection at the brake valve; then in service applications, lap the brake valve by hand, returning the handle slowly to positive lap position after the required reduction in brake pipe pressure has been made.

Fig. 11.—Automatic Lap.



EMERGENCY POSITION.

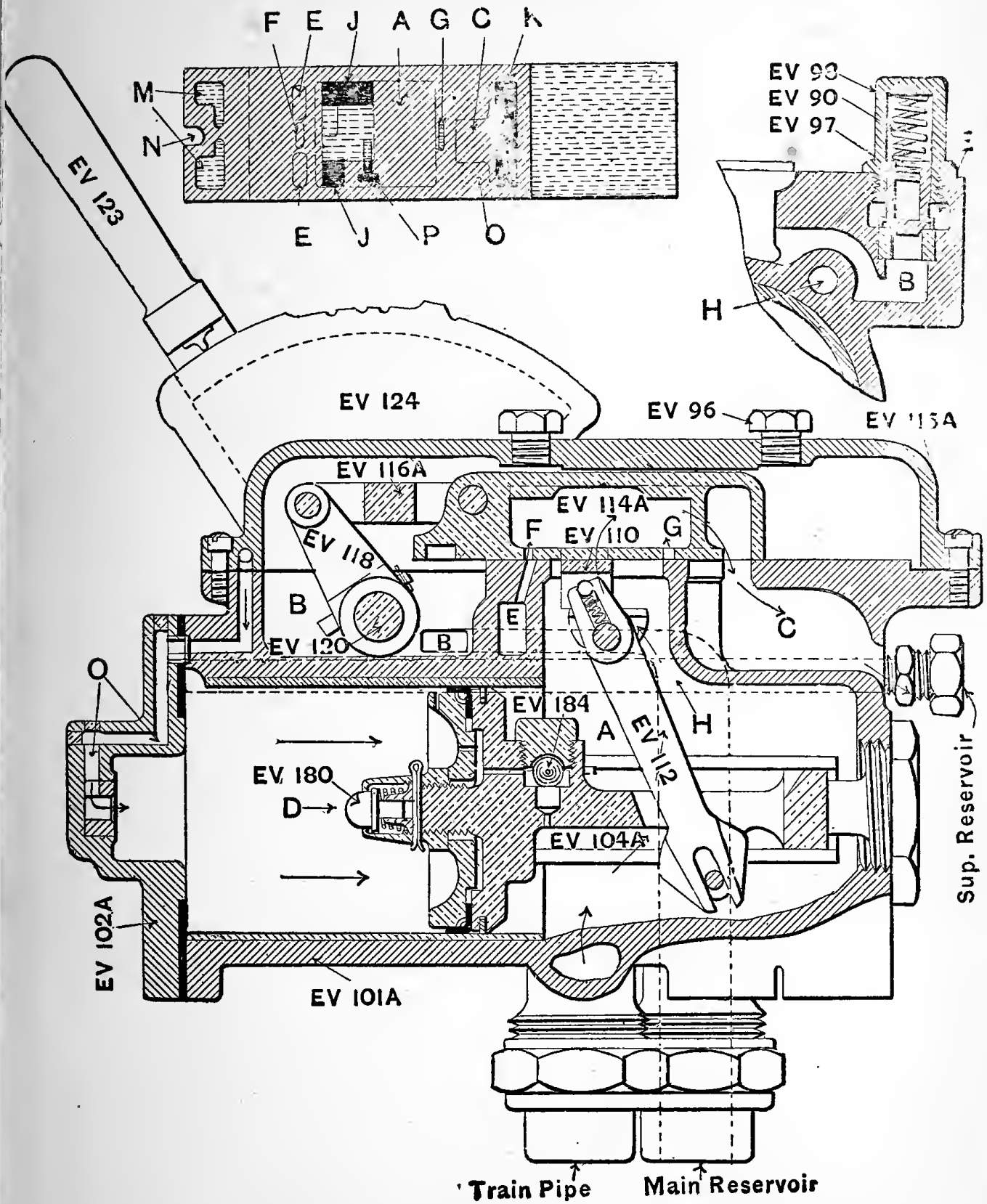
In this position the brake pipe has a large, direct passage to the atmosphere, and the air can escape quickly through the large ports J and K in the slide valve EV-114A to the exhaust port C in the seat, thence to the atmosphere.

When chamber "A" and the brake pipe pressure is reduced, supplementary reservoir pressure will move piston "EV-104A" to the right, which will cause cut-off valve "110" to move back, as shown in Fig. 12, but it does not close the large emergency exhaust ports "J" and "K."

The emergency position is for the purpose of producing a quick, heavy reduction in brake pipe pressure, so that all triple valves on the train will operate in quick action and apply the brakes in the shortest possible time.

Whenever there is danger of wreck or accident, which requires a quick stop to avoid, move the handle quickly to the emergency position **and leave it there** until the train stops.

Fig. 12.—Emergency.



DISMANTLING BRAKE VALVE.

The top cap EV 115 should first be removed and then the back cap EV 102A. The main slide valve EV 114A should be taken off, and the graduating or cut-off slide valve EV 110 lifted out; also the graduating valve spring EV 111. Next remove the graduating slide valve, lever fulcrum bolt EV 113 and lever EV 112, after which remove graduating piston EV 104A.

Do not attempt to remove the nuts from piston EV 104A before taking it out of the brake valve body, as to do so would probably result either in springing the groove in the piston stem, or in breaking off the dowel pin in the valve body.

After necessary repairs are made, the various parts should be thoroughly cleaned. Before assembling the valve the cylinder should be well covered with valve or high-grade machine oil, and the packing leather and packing ring on the piston should also be well lubricated. After the piston is replaced in the cylinder, the lever, lever-pin, the graduating valve, with its spring, should be put in, then the main slide valve placed on the seat and connected to the handle lever-shaft. The valve and seat should then be well oiled with valve oil. The back-cap should be replaced last. If a new gasket is applied between the cover and the body of brake valve, be sure the two port holes " O " are in it, and that they register with the corresponding ports in the valve body. After the valve cover is properly secured, the valve is ready for testing.

The brake valve should be tested with a brake pipe volume equal to that of about twenty-five cars. This volume is desirable in order to test

satisfactorily the equalizing feature of the valve.. To make sure that it will operate properly on long trains, the method of testing should be as follows:

TIGHTNESS OF MAIN SLIDE VALVE.

Empty the brake pipe by placing handle in emergency position, then place handle in lap position ; this will empty the supplementary reservoir; close the cut-out cock under the brake valve, and place the brake valve handle in one of the graduating notches, to close port "O." Maintain 90 pounds pressure in the main reservoir.

If the slide valve leaks the main reservoir air will pass into the brake pipe above the cut-out cock, and an increase of pressure will be indicated by the black hand of the air gage, if the gage is connected above the cut-off cock.

EQUALIZING PISTON TEST.

With the brake pipe pressure at 70 pounds, and the brake valve handle placed in the first service graduating notch, the brake pipe pressure should reduce 5 pounds. If the valve fails to cut off, it is an indication of a leak past the packing leather, or past the ball check valve EV 184; or a leak past both, allowing the air to pass from chamber D and supplementary reservoir into the brake pipe; or there is a leak from the back of piston EV104A to the atmosphere past a defective back head gasket EV167, from a supplementary reservoir connection, or there is a leak at the small port O in the slide valve seat.

To test for leakage to the atmosphere, use soapy water on back cap of the brake valve,

and connections to supplementary reservoir. If not found, test the piston by placing valve in emergency position to empty the brake pipe, then in second service notch; close the cut-out cock, and watch black-hand of gage; a leak will be indicated by black-hand of the air gage.

EXCESS PRESSURE—VALVE TEST.

With the brake pipe charged to 70 pounds, and a brake pipe volume the equivalent of engine and tender, and 90 pounds in main reservoir, the black hand should stand at 70 pounds. If there is a leak by the excess pressure valve, or the gasket between it and the body of brake valve. it will increase the brake pipe pressure, which will be indicated by black hand of air gage.

The reductions from the brake pipe pressure at 70 pounds in the service graduating positions should be 5, 3, 3, 5 and 7 pounds respectively. Care should be taken to have the brake pipe pressure just 70 pounds when making these reductions.

TIGHTNESS OF CUT-OFF VALVE.

After having ascertained that there is no leakage in chamber "D" back of piston "104A" place the handle in the first graduating notch. If a continuous blow occurs at the exhaust port, after making the required reduction in brake pipe pressure accompanied by the falling of the black hand of the gage, this valve is leaking.

NEW YORK B3 LOCOMOTIVE BRAKE EQUIPMENT.

The equipment known as the B3 is arranged in four different schedules to cover the general requirements of railroad service.

Schedule B3 is for engines in passenger or freight service, where but one brake pipe pressure is used. Both pump governor and pressure controller have single regulating heads, which should be adjusted for the standard brake pipe and main reservoir pressure.

Schedule B3-S is for switch engines only. A single pump governor and single pressure controller are used. The controller is set to give a brake pressure of 70 pounds and the pump governor, for 90 pounds main reservoir pressure, for ordinary switching service. However, when the engine is used for passenger switching service, and handles trains that are using 110 pounds brake pipe pressure, the pump governor should be adjusted to 110 pounds main reservoir pressure. When handling a train using the high pressure, close cock between the regulating and supply portions of the controller. This renders the controller inoperative, allowing the main reservoir pressure of 110 pounds to pass to the brake valve and brake pipe, so that trains using the high speed brake can be handled without delay without the necessity of carrying additional apparatus. A quick release valve is furnished with this schedule, to be placed in the straight air pipe, so that the brakes can be released quickly, permitting quicker movement. The divided reservoir and accelerator valve are not furnished with this schedule. The supplementary reservoir is substituted for the divided reservoir.

Schedule B3-HP is for freight service where heavily loaded trains are handled on heavy grades, or loads handled down grades and empties up. Both regulating portions of the pump governor and pressure controller are duplex so that pressures of 70 and 90 pounds can be carried in the brake pipe and 90 and 110 pounds in the main reservoir for the ordinary brake pipe pressure and the high pressure control.

For the operation of these duplex regulating portions, three-way cocks are provided, being connected as shown in the piping diagram. To operate these cocks, turn the handle in line with the pipe leading to the regulating head to be used, high or low pressure as desired. This will cut in the head to regulate the supply portion, and cut off the pressure to the one not in use.

Schedule B3-HS is the high speed brake. It includes the duplex pressure controller and the duplex pump governor. The regulating heads of the pressure controller should be adjusted to 70 pounds and 110 pounds for brake pipe pressure, and the pump governor heads adjusted to 90 pounds and 130 pounds for the main reservoir pressure. A union four-way cock is used with the regulating heads of the pressure controller. This is a special cock with a connection to each regulating top, one to the supply pipe between the controller and brake valve, and one to the pipe between the brake valve and accelerator reservoir. When the handle of the four-way-cock is in the position to operate the regulating head adjusted to 110 pounds brake pipe pressure, a small port in the accelerator reservoir connection is brought into communication with a port to the atmosphere. The object of this

port is to prevent more than the usual predetermined reduction of brake pipe air, obtained in the graduating notches, taking place with 110 pounds pressure. A union three-way cock connected to the main reservoir and pump governor regulating tops, is used to change the main reservoir pressures.

On the folded sheet will be found a piping diagram of the B3 equipment, showing the several parts, as well as the proper pipe connections. This equipment is an improvement on former equipments. It not only includes all necessary features for the automatic brake but also a straight air brake for the locomotive and tender. all operated by the automatic brake valve, without any additional positions.

Other parts of the equipment fully described under their different headings are the 1¼ inch pressure controller by which the brake pipe pressure is regulated; the accelerator valve which assists the brake valve in discharging brake pipe air when making service applications with long trains, the ¾ inch controller which controls the straight air brake pressure; the high speed controller which acts as a reducing valve for the driver and truck brake cylinders, the lever safety valve and the double check valve.

MANIPULATION.

To apply the automatic brakes on the locomotive and train, move the handle of the brake valve to the graduating notch necessary to make the required brake pipe reduction.

To release both locomotive and train brakes, move the handle to Running and Straight air release position.

To release the train brakes and hold the locomotive brakes set, move the handle to Automatic release and Straight air application position.

To apply the locomotive brakes (Straight Air), move the handle to Full Automatic release and Straight Air Application position.

To release the locomotive brakes move the handle to Running and Straight Air release position.

To apply the brakes in an emergency, move the handle quickly to Emergency position and leave it there until the train stops.

In case the automatic brakes are applied by the bursting of a hose, the train parts, or a conductor's valve is opened, place the handle in Lap position to retain the main reservoir pressure.

To graduate off or entirely release the locomotive brakes while holding the train brakes applied, use the lever safety valve to make the required reduction.

The cylinder gage will show at all times the pressure in the locomotive brake cylinder and should be observed in brake manipulations.

Where there are two or more locomotives in a train, cut-out cock No. 1 should be turned to close the brake pipe and the brake valve handle carried in Running and Straight Air release position on all locomotives except the one from which the brakes are operated.

In case it becomes necessary to cut out the Straight Air brake, close cut-out cock No. 3, located in the straight air pipe.

To cut out the automatic brake on the engine, close cut-out cock No. 6, located in the pipe connecting the triple valve with the double check valve. By locating the cut-out cock at this point the auxiliary reservoir will remain charged if the brake is cut out, and can be cut in immediately should it be so desired. This cut-out cock and also cut-out cock No. 3 are special; they are of the three-way pattern and when turned off drain the pipes leading to the double check valve, which insures the check valve remaining seated in the direction of the closed cock.

The main reservoir cock No. 4 is to cut off the supply of air when removing any of the apparatus except the governor.

The straight air controller is to limit the pressure in the driver, truck and tender brake cylinders for the straight air brake, and should be adjusted to 40 pounds pressure.

B3 BRAKE VALVE.

Figure 13 is a longitudinal side section of the brake valve (Running position), showing the main slide valve EV 312, and how the graduating valve EV 317 is controlled by the piston EV 311 and lever EV 302, which is identically the same as with the " B-1 " brake valve, which has been fully explained, also port O in the back cap, closed by the vent valve, EV 180. This view also shows the different positions of the brake valve handle.

Figure 14 is a top view of the valve with the cover, slide valve and handle removed, showing the seat and connections for the straight air and divided reservoir pipes. A shows the opening through the slide valve seat to the

brake valve chamber A, beneath the slide valve. B is a cavity back of the slide valve seat, into which the air flows from the main reservoir pipe, although all the space under the valve cover and abovt the slide valve is known as

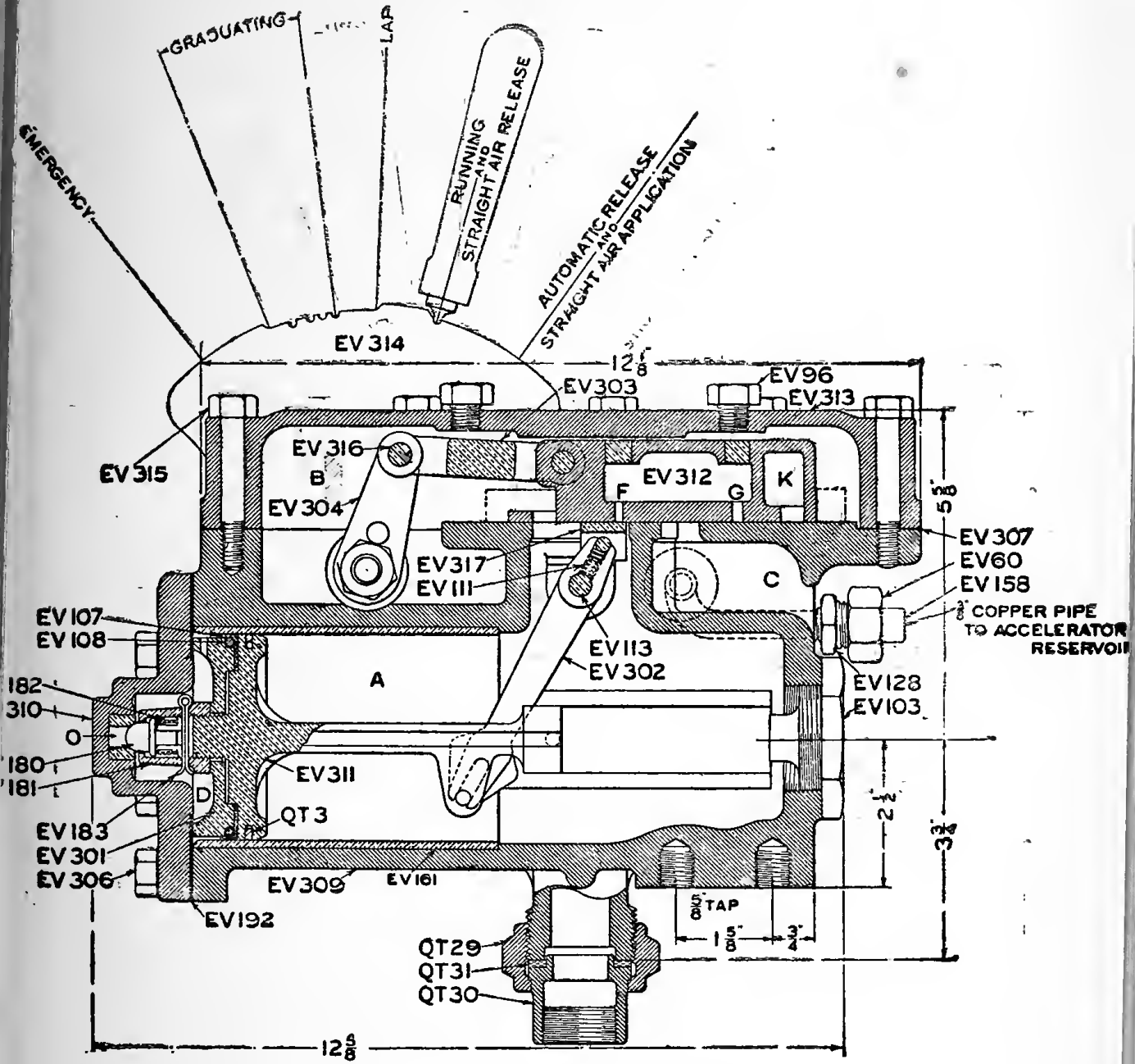

GRADUATING
LAP
RUNNING AND STRAIGHT AIR RELEASE
AUTOMATIC RELEASE AND STRAIGHT AIR APPLICATION
EMERGENCY
EV 314
12 1/8"
EV 303
EV 96
EV 313
EV 315
EV 316
B
EV 304
F
EV 312
G
K
5 5/8"
EV 307
EV 60
EV 158
EV 317
EV 111
C
1/8" COPPER PIPE TO ACCELERATOR RESERVOIR
EV 107
EV 108
EV 113
EV 302
A
EV 128
EV 103
182
310
O
180
181
EV 311
D
QT 3
2 1/2"
3 3/4"
EV 183
EV 301
EV 306
EV 309
EV 161
EV 192
5/8" TAP
1 5/8"
3/4"
QT 29
QT 31
QT 30
12 5/8"

Fig. 13.

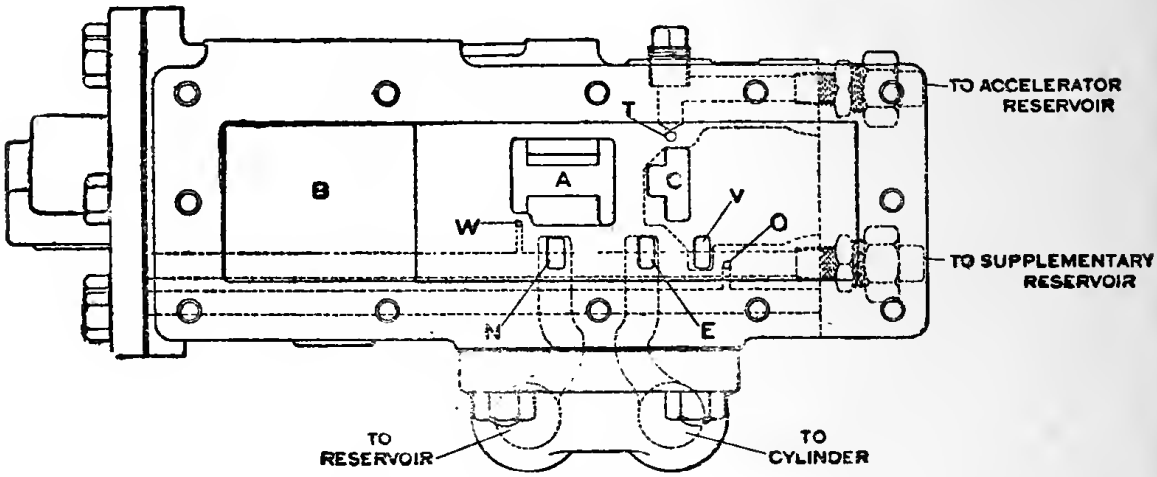


Fig. 14.

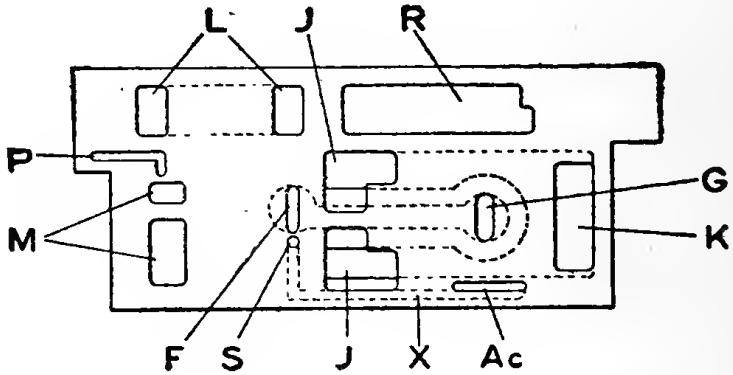


Fig. 15.

chamber B. C is the exhaust passage. V is through to the exhaust passage and is an exhaust port for the straight air brake in running and straight air release positions, and is also an exhaust port for the air from chamber D, through port O in the release, running and lap positions. Port T is to the accelerator reservoir. Port W is to the passage H and the supplementary reservoir. The location of port O in the seat is also shown.

Port O is used for the purpose of venting air from chamber D to the atmosphere, so as to permit piston EV 311 to return to its normal position (Fig. 13), when releasing brakes. It

runs from the vent valve seat through the back cap, lengthwise through the body of the brake valve up to the seat of the slide valve. It is connected to the exhaust passage by cavity R in the slide valve, and port V in the seat, in Full release, running and lap positions.

Chamber D air is prevented from escaping to the atmosphere in these positions by the vent valve EV 180 on the end of piston EV 311. Just before the slide valve reaches the first graduating notch, it covers port O, so that when the piston moves forward to automatically close the service exhaust port F, and unseats vent valve EV 180, chamber D air only gets to the face of the slide valve. When the brake valve is placed in Full release, running or lap positions, air from chamber D flows through port O, cavity R and port V to the atmosphere until the pressure in chamber D is slightly below that in chamber A (brake pipe), when the brake pipe pressure being the greater, it forces piston EV 311 to the position shown in Fig 13, seating the vent valve, and preventing further escape of chamber D air.

Figure 15 shows the face of the slide valve. F and G are the service exhaust ports and are connected by a passage through the center of the slide valve. J and K are the emergency exhaust ports connected by passages on each side of the central passage, connecting F and G. S is a small port connected by passage X to the elongated port A, which registers with port T in the seat in [illegible] service application positions. P is a groove whose function is to connect port W and the supplementary reservoir with brake pipe pressure in release and running positions. L is a passage through which air passes from the main reservoir pipe to the brake

cylinder pipe in straight air application position. R is a cavity connecting ports E and V in the running and straight air release positions to release the straight air brake and O and V in release, running and lap positions. It also permits the partial opening of port N to E in the last graduating notch and full opening in emergency position. Ports M are through the slide valve and are for charging the brake pipe.

Main reservoir air, reduced to brake pipe pressure by the pressure controller, flows into chamber B. The slide valve EV 312 controls the flow of air from the main reservoir to the brake pipe and from the brake pipe to the atmosphere. The brake pipe is connected to chamber A. Discharge of brake pipe air to the atmosphere for service applications occurs through ports F and G and exhaust passage C, but for emergency applications through ports J and K and exhaust passage C. In full automatic release position air is free to pass from the main reservoir to the brake pipe through ports M, and past the end of the slide valve EV 312. In the running position ports M only are open between the main reservoir and brake pipe, but they are sufficiently large to permit release of train brakes. Small slide valve EV 317 is a cut-off or graduating valve operated by piston EV 311 and lever EV 312. In service applications it automatically laps port F and stops the discharge of brake pipe air when the brake pipe reduction corresponding to the service graduating notch in which the handle is placed has been made. Piston EV 311 which is exposed on one side to brake pipe pressure and on the other to chamber D or supplementary reservoir pressure, through the agency of lever EV 302 causes valve EV 317 to move automatically whatever distance is necessary to close port F.

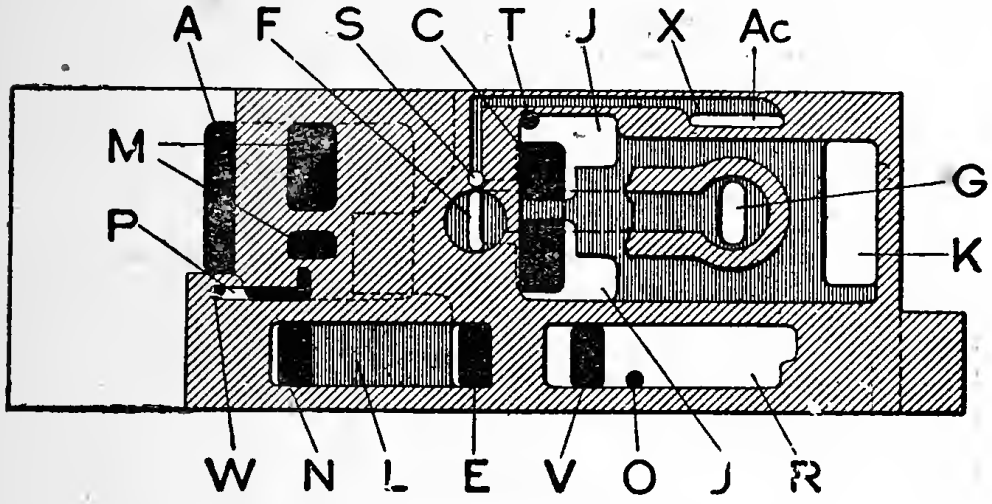


Fig. 16.—Release Position.

Automatic Release and Straight Air Application Position (Fig. 16). The purpose of this position is to promptly release and recharge the automatic brakes and to apply the straight air brakes or retain the pressure in the locomotive and tender brake cylinders. In this position air flows directly from chamber B, (main reservoir) into chamber A, (brake pipe) past the end of the slide valve and through ports M. Port O is open to the atmosphere through port V to permit piston EV 311 to return to its normal position. Port T is open to the atmosphere through J and C. The supplementary reservoir is being charged to brake pipe pressure through groove P and port W from chamber A. Port E is brought into communication with port N by passage I, permitting air to pass to the locomotive and tender brake cylinders through the straight air pipe and double check valve until shut off by the ¾ inch pressure controller, the regulating top of which is connected to the straight air pipe and adjusted at 40 pounds. By placing the valve handle about midway between release and running positions the straight air ports can be lapped, making it possible to

increase or decrease the brake cylinder pressure as may be necessary.

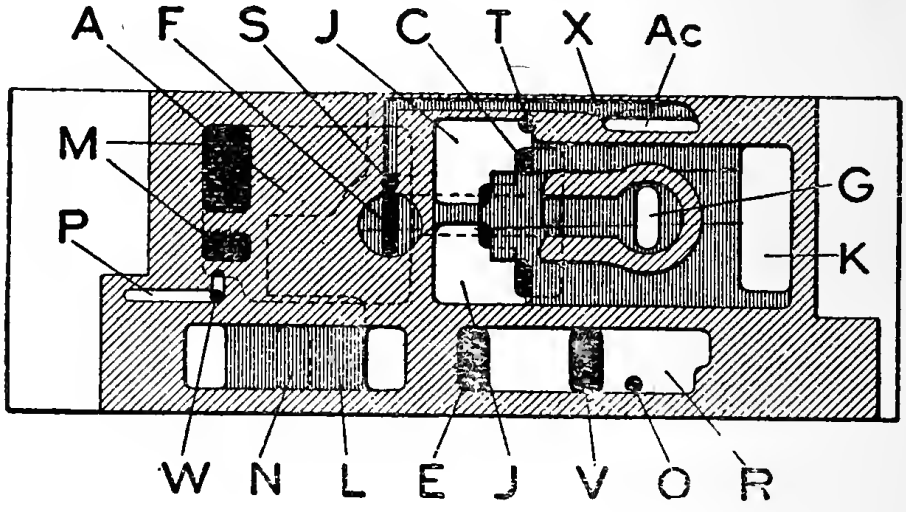


Fig. 17.—Running Position.

Running and Straight Air Release Position (Fig. 17). This is the proper position in which to place the handle when wishing to release the train and locomotive brakes simultaneously, or to release the straight air brake when it only has been applied. Air passes from the main reservoir to the brake pipe through ports M. Port N is closed. Port E is brought into communication with port V and the atmosphere by cavity R, releasing the straight air brake. Ports O and T are still open to the atmosphere as in full release position. Port T is open to the atmosphere through J and C in release and running positions, so that in case of a release following a partial application, the accelerator reservoir pressure can escape and prevent the operation of the accelerator valve. Groove P still holds port W in communication with the brake pipe pressure in chamber A.

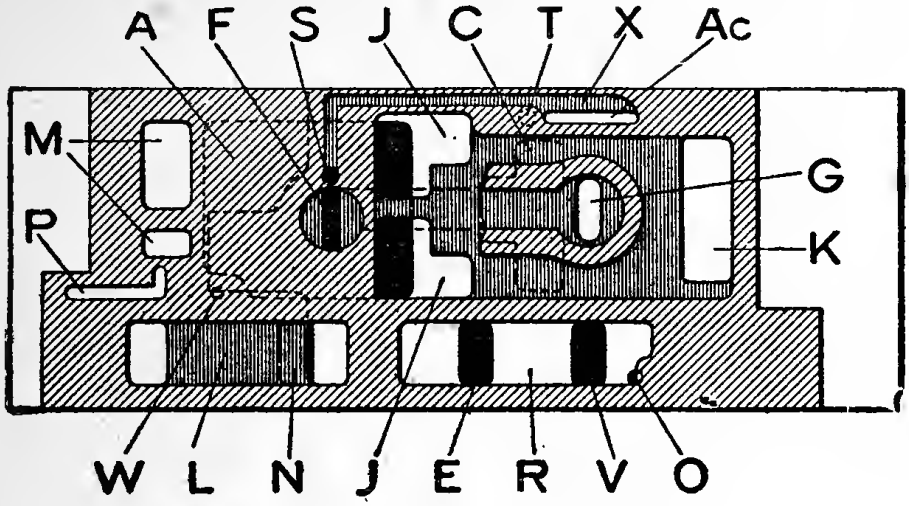


Fig. 18.—Lap Position.

Lap Position (Fig. 18). The brake valve handle should be placed in this position when a hose bursts, the train parts or a conductor's valve is opened to save the main reservoir air. All ports are closed in this position excepting port O, which is open to the atmosphere through port V and the exhaust passage in release, running and lap positions.

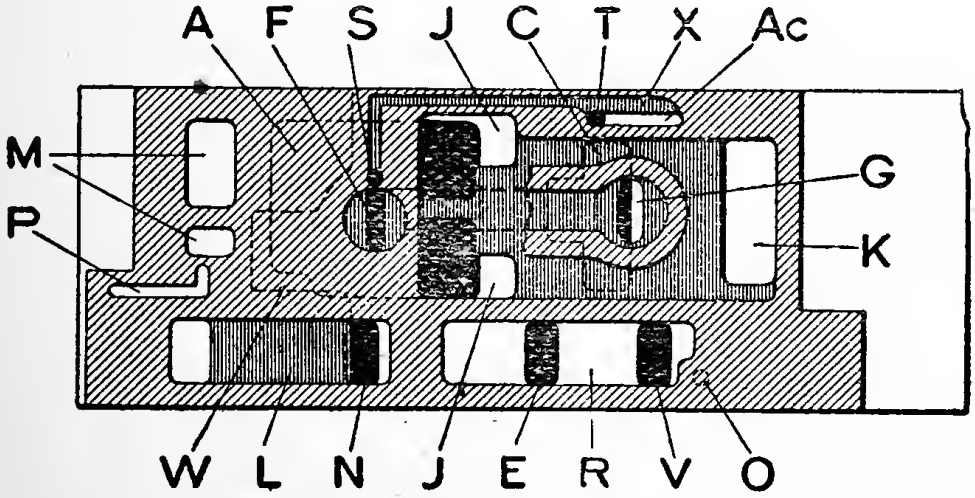


Fig. 19.—First Graduating Notch.

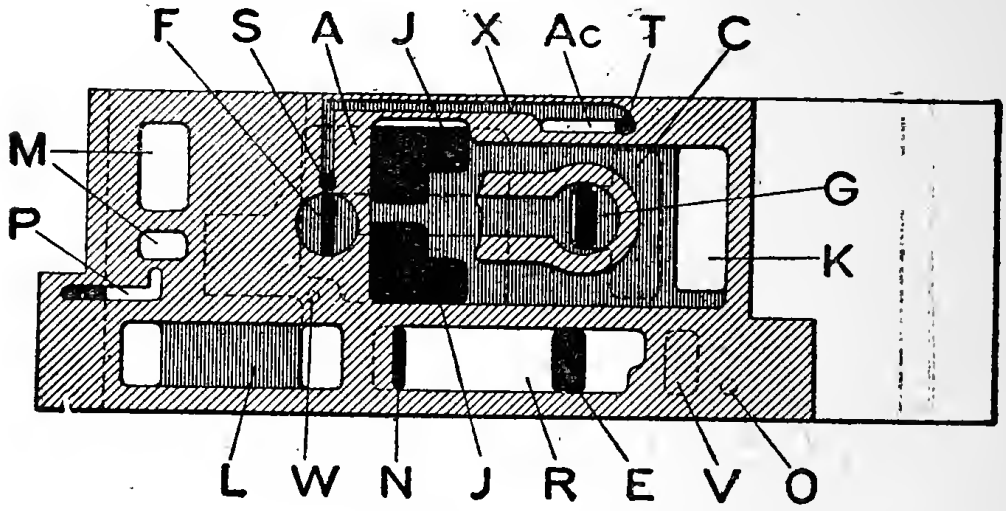


Fig. 20.—Last Graduating Notch.

Service Application Position (Figs. 19 and 20). This position is for the purpose of gradually applying the brakes and is divided into five graduating positions designated by notches on the quadrant. The reductions obtained in the different notches are respectively, 5, 8, 11, 15 and 23 pounds. The amount of the initial reduction should always be governed by the length of the train, speed, grade, etc. Always place the handle of the brake valve in the notch which will give the required reduction. When the handle of the brake valve is moved to the first graduating notch the slide valve is in the position shown. Port O is closed to prevent the escape of chamber D pressure. Port F is moved back of the graduating valve EV 317 and port G registers with the exhaust port C. Brake pipe air now flows to the atmosphere. It also flows through port S, passage X and port T to the accelerator reservoir, building up a pressure to operate the accelerator valve. As soon as the pressure in the brake pipe reduces, the pressure in chamber D, being now greater than brake pipe pressure, it begins to expand to equalize with the brake pipe pressure. In

doing so it moves piston EV 311 forward. The piston carries with it the lower end of the graduating valve lever EV 302, which is so proportioned that the graduating valve EV 317 on the other end of it, is just moved back far enough to close ports F and S when the pressures in chamber D and the brake pipe have equalized. This stops the flow of air from the brake pipe to the atmosphere and to the accelerator reservoir, (see accelerator valve). This action is called automatic lap and it takes place in all the graduating positions. A further reduction of the brake pipe pressure is made by moving the handle back to any of the service notches, the piston moving farther forward for each successive reduction. The action of the brake valve is the same and the ports are in the same relation to each other in all service positions of the brake valve except the last graduating position. In this position a partial opening of port N admits air slowly to the locomotive and tender brake cylinders through cavity R and port E up to the adjustment of the controller on the straight air pipe. This is to insure full braking pressure on the engine with a full application regardless of piston travel and brake cylinder leakage.

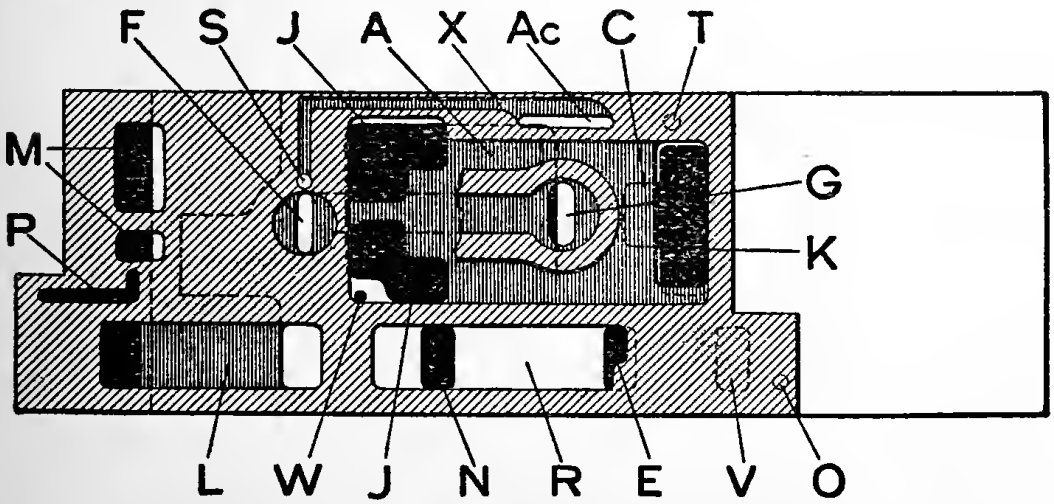


Fig. 21.—Emergency Position.

Emergency Application Position (Fig. 21). This position is for the purpose of producing a quick, heavy reduction in brake pipe pressure so that all triple valves on the train will operate in quick action and apply the brakes in the shortest possible time.

Ports J register with chamber A and K with the exhaust port C, allowing brake pipe air to escape rapidly to the atmosphere. Cavity R allows air from the main reservoir to pass through ports N and E to the locomotive brake cylinders, and the full pressure of the straight air brake is maintained on the engine.

PRESSURE CONTROLLER.

The pressure controller is in reality, a part of the brake valve, and is connected in the main reservoir pipe near the brake valve to control brake pipe pressure. The principle of operation is the same as a pump governor. The regulating and supply portions are separate, being connected by piping, and the regulating heads connect directly to the pipe between the supply portion and the brake valve.

With the pressure controller the excess pressure is confined to the main reservoir, and while it has sufficient capacity to promptly release the brakes and recharge the auxiliary reservoirs on a train of any length, there is no danger of overcharging.

The controller is made in two styles, single and duplex, to cover the requirements of the different schedules. Fig. 22 is a sectional view of a duplex regulating portion and Fig. 23 is a sectional view of the supply portion.

Referring to Fig. 23, connection with the main reservoir is made at MR, and by means of the cored passage air is free to pass to the under side of the valve, PG 95. Connection BV leads to the brake valve, main reservoir connection, and connection D to the regulating portion (single or duplex), connecting at D in Fig. 22.

In operation, as soon as the pressure in the brake pipe is great enough to overcome the resistance of the spring PG 10, which is holding the diaphragm PG 13, seated over port B, the pressure will pass through passage E to connection D, and by piping to the space E, in the supply portion of the controller above the piston PG 4, forcing the piston and valve PG 95 down until seated, cutting off communication between main reservoir and brake pipe.

As soon as the pressure falls in the brake pipe below the adjustment of spring PG 10, the latter will force diaphragm PG 13 to its seat, closing off port B, whereupon pressure in passage E and piping connecting supply and regulating portions and space E above piston PG 4 will immediately escape to the atmosphere through the small port C, in the regulating head of the controller, after which main reservoir pressure will lift valve PG 95 off its seat and again open communication to the brake valve, thus maintaining a constant pressure in the brake pipe.

Port X in the supply portion of the controller

Pressure Controller.

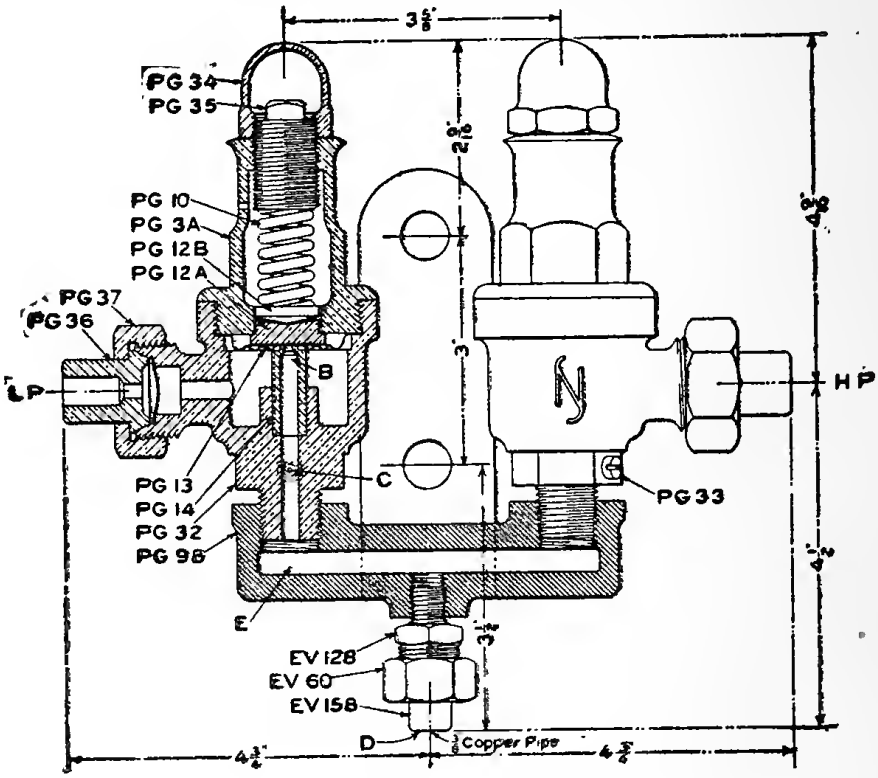


Fig. 22.

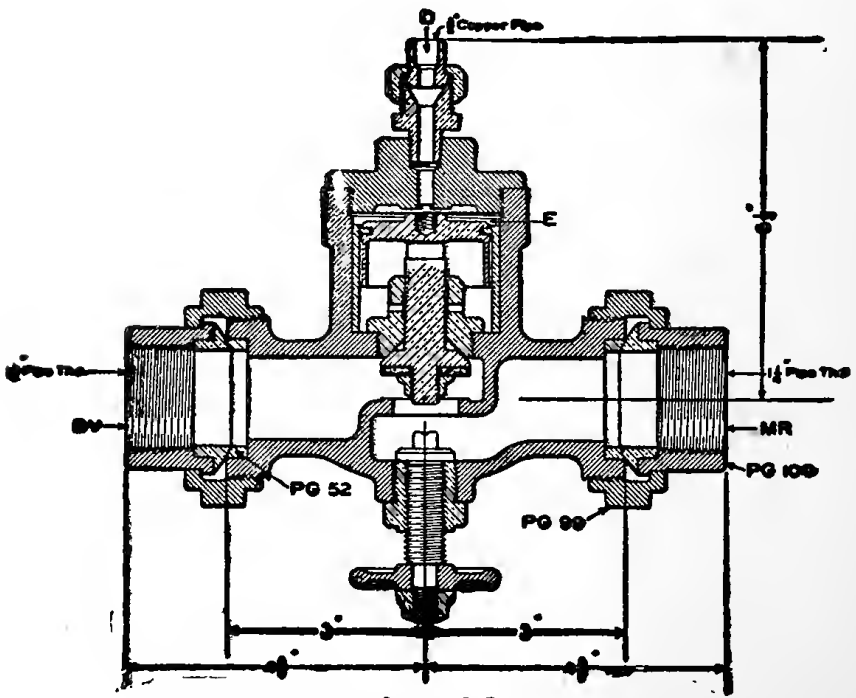


Fig. 23.

connects the under side of piston PG 4 with atmosphere, so that it will be free to operate and to discharge any leakage by the ring PG 24 or Valve PG 95.

The regulating portions are provided with brackets, so that they can be attached to the cab in some convenient place where they will be handy for adjustment. The adjustment of these regulating heads is accomplished by means of nut PG 35, which regulates the tension of spring PG 10.

As each regulating head has a vent port C, to avoid unnecessary waste of air, one of these heads should be plugged.

The hand wheel, PG 45, can be used in case of any defect that would cause a sluggish action of the controller. By screwing the wheel up, it will lift the valve, PG 95, off its seat and allow the free passage of air from the main reservoir to the brake valve. The controller will then be inoperative, main reservoir and brake pipe pressures will be equal until the controller is again restored to its operative condition.

A ¾ inch controller is located in the pipe between the main reservoir and the brake valve, to control the straight air brake pressure. The regulating head is connected to the straight air pipe between the brake valve and the double check valve. It should be adjusted for 40 pounds.

ACCELERATOR VALVE.

It is well known that with the ordinary brake valves alone, it is almost impossible to set all the brakes on trains of 75 to 100 cars without

making a very heavy reduction. This is caused by the back flow of air from the auxiliary reservoirs to the brake pipe through the feed grooves, and from the brake cylinder to the atmosphere through the leakage grooves. It is the result of the comparatively slow brake pipe reduction through the service application ports of the brake valves, which for obvious reasons can not be enlarged. The accelerator valve was designed to overcome this difficulty. Its duty is to assist the brake valve in discharging brake pipe air when making service applications on long trains, and to bring about a more uniform and prompt application of the brakes than is possible with the ordinary brake valves. It operates only when a service application of brakes is made with the brake valve and then only when the volume of brake pipe air is sufficient to warrant its use. The reductions, however, are no greater with the accelerator valve than with the former types of brake valves, as the automatic cut-off of the brake valve controls the flow of air that actuates the accelerator. This valve does exactly what its name would imply. It accelerates the discharge of brake pipe air. The operation of the accelerator valve is automatic, it opens about four seconds after the brake valve handle has been moved to the graduating notch and closes in about the same length of time after the graduating valve has closed ports F and S in the slide valve. It requires from about ten to twelve pounds pressure in the large compartment of the divided reservoir to operate it, consequently, it does not open with a shorter train than eight cars, as with that length of a train the automatic lap of the brake valve takes place before sufficient pressure has been accumulated in the divided reservoir to move the

piston of the accelerator valve down against the spring.

It is bolted to the divided reservoir, the large chamber of which is the accelerator reservoir and the small one the supplementary reservoir.

The arrangement of piping to it is shown in the piping diagrams. Fig. 24 is a sectional view. The working parts are the piston RV 65, slide valve RV 74, and slide valve spring EV 656, valve stem RV 67 with leather seat RV 70 and spring QT 231.

Brake pipe pressure is always present in chamber O, around the slide valve RV 74, and is prevented from escaping to chamber B by the leather seat RV 70, which is held to its seat by the spring QT 231. There is an oblong port, a, in the slide valve and a triangular port, b, in the slide valve bush with its point upward. When the brake valve is placed in the service position port S in the slide valve is open to the brake pipe, and the long port Ac, also in the slide valve, registers with port T in the seat, allowing brake pipe air to pass through ports S and T to the accelerator reservoir and to the top of piston RV 65, which is always in direct communication with the accelerator reservoir. When a pressure of from ten to twelve pounds is accumulated in the reservoir, the piston, valve stem, and slide valve are moved down, compressing spring QT 231. Port a then registers with b, but as the small part of the port opens first the brake pipe air flows slowly to the atmosphere, the discharge increasing as the port opens wider until the full travel of the piston and slide valve gives a full opening of the port. When the cut-off valve of the brake valve goes to automatic lap and closes port S, air

stops flowing to the accelerator reservoir. The pressure on piston RV 65 reduces through ports R and T in the body of the valve and through port S, in the piston. As soon as the pressure above the piston has been reduced sufficiently, the spring QT 231 pushes the slide valve and piston upwards, first closing port R, then ports a and b, lastly closing the leather seated valve RV 70, and stopping the flow of brake pipe air to the atmosphere. The piston closes port R before the slide valve closes port b, so that the air from the accelerator reservoir, flowing more slowly through the port S in the piston, gives the slide valve the slow closure desired.

This action of the accelerator valve will allow a much larger volume of air to pass from the brake pipe than could flow in the same time through the service ports F and G in the brake valve.

It stays open longer with a long train than with a short one, because the volume of brake pipe air to be reduced is greater and the cut-off valve EV 317 stays open longer.

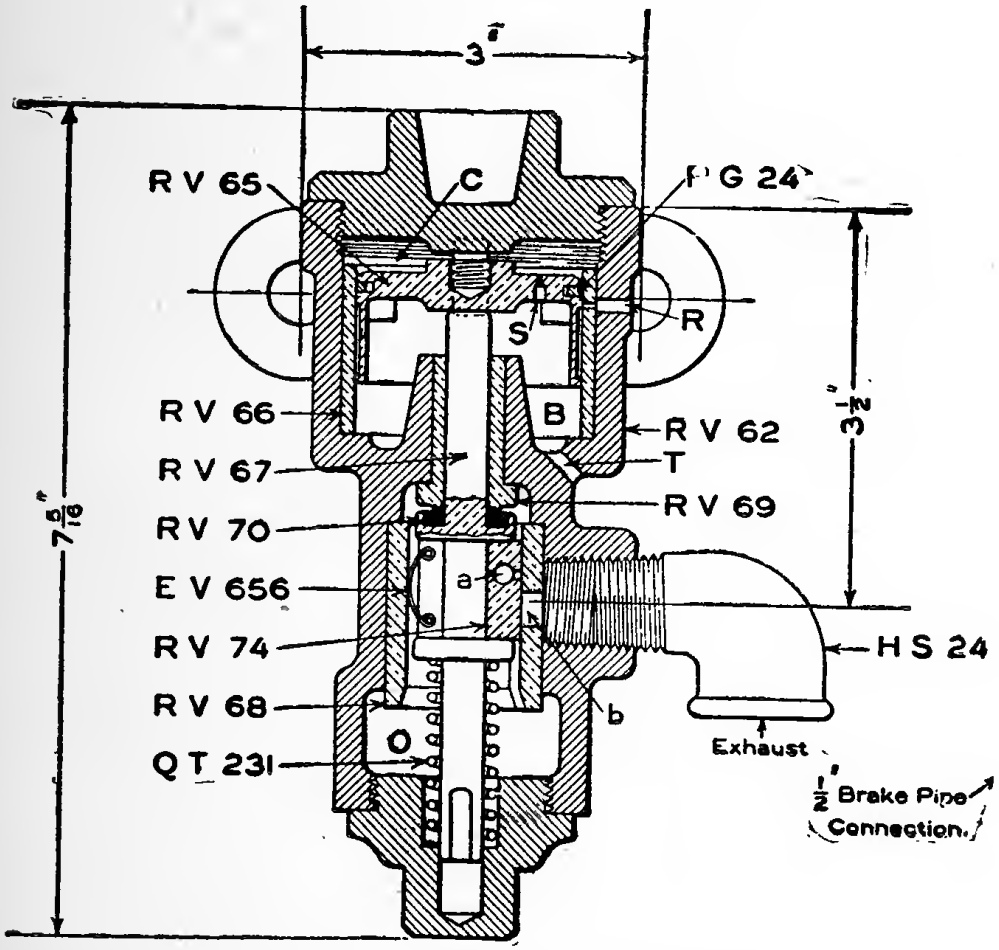


Fig. 24.—Accelerator Valve.

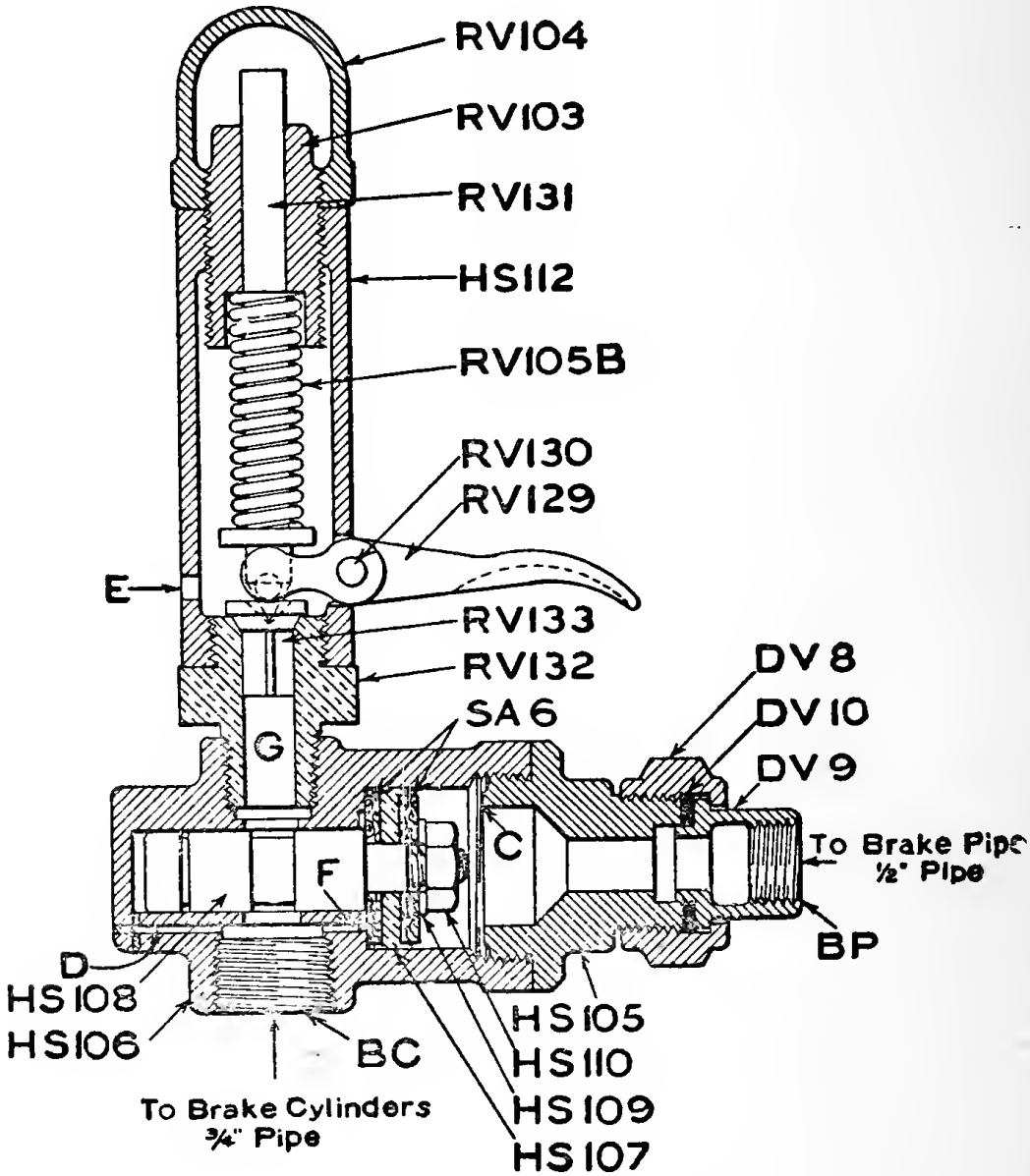


Fig. 25.—High Speed Controller Lever Safety Valve.

The High Speed Controller is used with the high speed brake. Fig. 25 is a sectional view of it, showing the operative parts. These are piston HS 107 with valve HS 108, which is provided with one large and one smaller annular groove, as shown, the spring RV 105 B, valve stem RV 131, pop valve RV 133 and the lever handle RV 129.

It is connected to the brake cylinders at BC and the brake pipe at BP. Its normal position is shown in the illustration, where it is held by brake pipe pressure During all ordinary service applications the piston remains in this position and brake cylinder pressure can pass freely to the safety valve through the large groove, when higher than that which safety valve is set to retain. However, when an emergency application is made the brake pipe pressure is greatly reduced, the brake cylinder pressure will move the piston and valve their full traverse to the seat C. This movement brings the smaller groove directly under the passage G, which restricts the passage of brake cylinder air to the safety valve and causes a gradual blow down until stopped by the safety valve. The safety valves should be adjusted to 53 pounds, and whether used alone or with the high speed controller are piped to the engine brake cylinders so that they will relieve the cylinders of all over that amount, whether obtained with the automatic or straight air application.

Ports F and D allow the brake cylinder pressure to circulate around the piston HS 107 and back of valve HS 108 so that they will move with a slight difference of pressure.

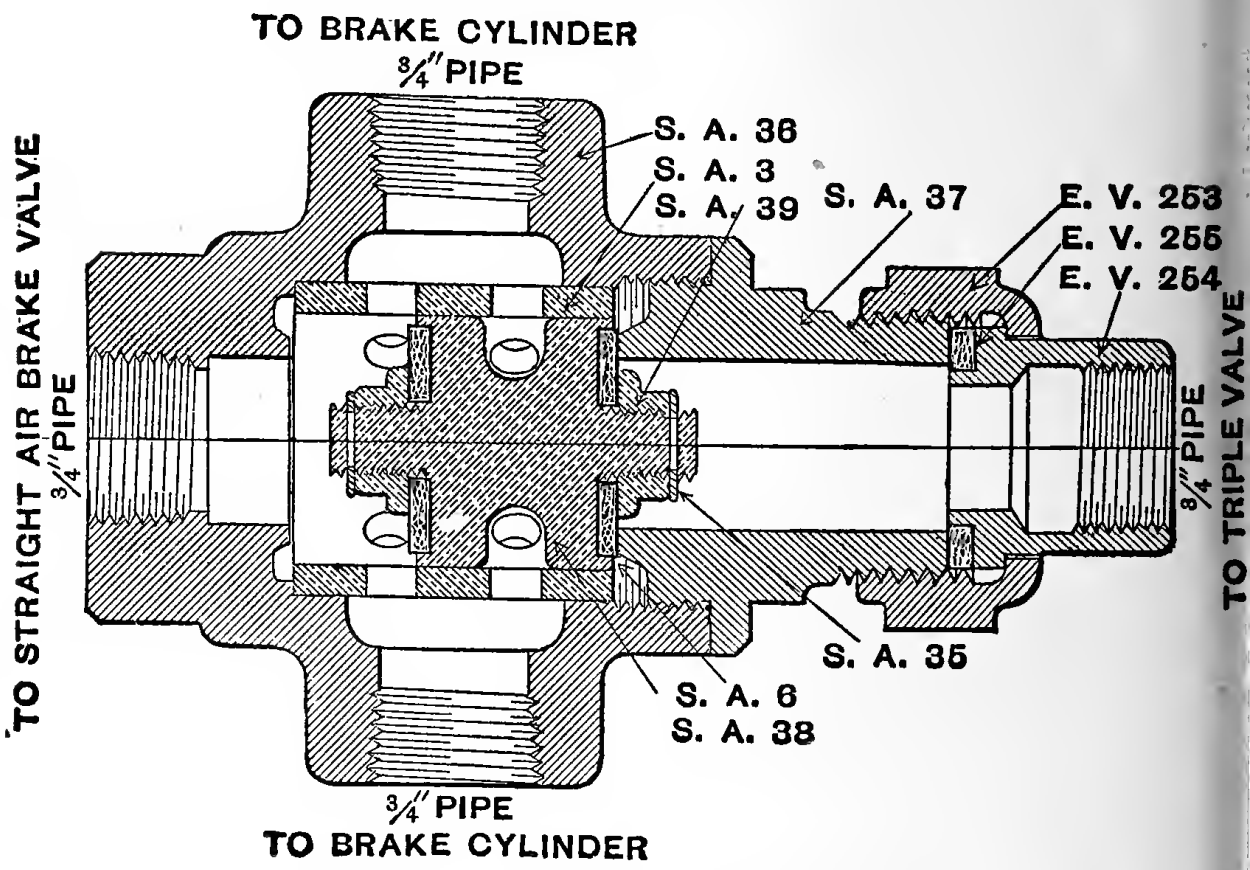


Fig. 26.—Double Check Valve.

DOUBLE CHECK VALVE.

Referring to the piping diagram, the double check valve, Fig. 26, is located in the piping between the straight air brake valve and the brake cylinders, also between the triple valve and the brake cylinders, in a horizontal position so it will not move by gravity. One end is coupled to the triple valve, the other end to the straight air brake valve. The side connections lead to the brake cylinders, or one side may be used for the safety valve, or a driver brake cylinder can be coupled to each side and the safety valve located in the cylinder pipe. When the straight air is used it moves the valve "SA-38" over to the right as shown, which prevents the air escaping at the exhaust port of the triple

valve, and the air passes by the other end of the valve to the brake cylinders. When the automatic is applied, air from the triple valve moves valve "SA-38" so the opposite side of the valve prevents air escaping at the brake valve, at the same time allows it to pass by the other end of the valve to the brake cylinders. Therefore, the function of the double check valve is to automatically connect the brake cylinders with either the automatic or straight air, and to prevent air escaping at exhaust port of one while the other is being operated. For defects see page

NEW YORK QUICK ACTION TRIPLE VALVE.

As some of the moving parts of the triple valve are at right angles to each other, the following diagrammatic drawings, where all parts are shown in one plane, will make it easier to study, than a true drawing of the valve. Referring to the several parts when applying the brake, each part is numbered, as it moves, in its turn, beginning with No. 1.

The service parts of the quick action triple are the piston (1), graduating valve (2), and slide valve (3). The emergency parts are the vent-valve piston (4), vent-valve (5), quick action valve piston (6), quick action valve (7), and check valve (8). The service parts are operative, both in service and emergency application, but the emergency parts operate in emergency application only.

RELEASE AND CHARGING POSITION.

Fig. 27 shows the triple in release and charging position. Air from the brake pipe enters the triple valve at "A" and passes through the feed groove "B" to the auxiliary reservoir "R," until the auxiliary reservoir and brake

pipe pressure are equal. It also fills the chamber "G" between the main piston (1) and the vent-valve piston (4), through the port "F" in the stem of the vent-valve piston. Cavity "V" in the slide valve connects ports "R" and "E," allowing air from the brake cylinder to pass to the atmosphere, thus releasing the brake.

SERVICE APPLICATION.

A service reduction of the brake pipe pressure, permits the auxiliary reservoir pressure to move the piston slide and graduating valve to the left, to service application position, as shown in Fig. 28. The first movement of the piston closes the feed groove "B" and the graduating valve moving with it, uncovers port "S." The slide valve then moves to the left closing the exhaust port, "E," and bringing the service port "S" directly over port "R," allowing auxiliary reservoir air to pass through ports "S" and "R" to the brake cylinder. When the brake valve has been lapped, and the flow of air from the auxiliary reservoir to the brake cylinder has reduced the pressure in the former slightly less than that in the brake pipe, the brake pipe pressure moves the piston and graduating valve to the right, to lap position, closing port "S." Fig. 29. Further reductions of the brake pipe pressure produce the same action of the triple piston and graduating valve, until a full service reduction of about twenty pounds has been made, when the piston and slide valve and graduating valve will remain in the position shown in Fig. 28, and the brake cylinder and auxiliary reservoir pressures will be equal.

In service applications the pressure in chamber "G" reduces with the brake pipe pressure through port "F" and has no effect on piston (4).

EMERGENCY APPLICATION.

Fig. 30. When a sudden heavy reduction of the brake pipe pressure is made, piston (1) moves to the left so rapidly that the air chamber "G" can not escape through port "F" as quickly as the brake pipe pressure is reduced. It therefore cushions, momentarily, upon piston (4), moves it to the left, unseating vent valve (5), permitting brake pipe air to escape into passage "H," where it forces piston (6) to the right, and then escapes to the atmosphere through port "J," thereby producing the brake pipe reduction necessary to transmit quick action to the next brake.

When piston (6) moves to the right, it also unseats quick action valve (7), permitting auxiliary reservoir air to flow rapidly through passages "K" and "L," unseating check valve (8) and passes into "C" and the brake cylinder. Auxiliary reservoir air also flows through the service ports "S" and "R" to the brake cylinder, thus causing an instant equalization of the auxiliary and brake cylinder pressure. As soon as equalization takes place, the springs return all emergency parts to their normal position, leaving only the piston slide and graduating valve in the application position, as shown in Fig. 28. When the brake pipe pressure is restored, they return to release position, Fig. 27.

NEW YORK QUICK ACTION TRIPLE VALVE.

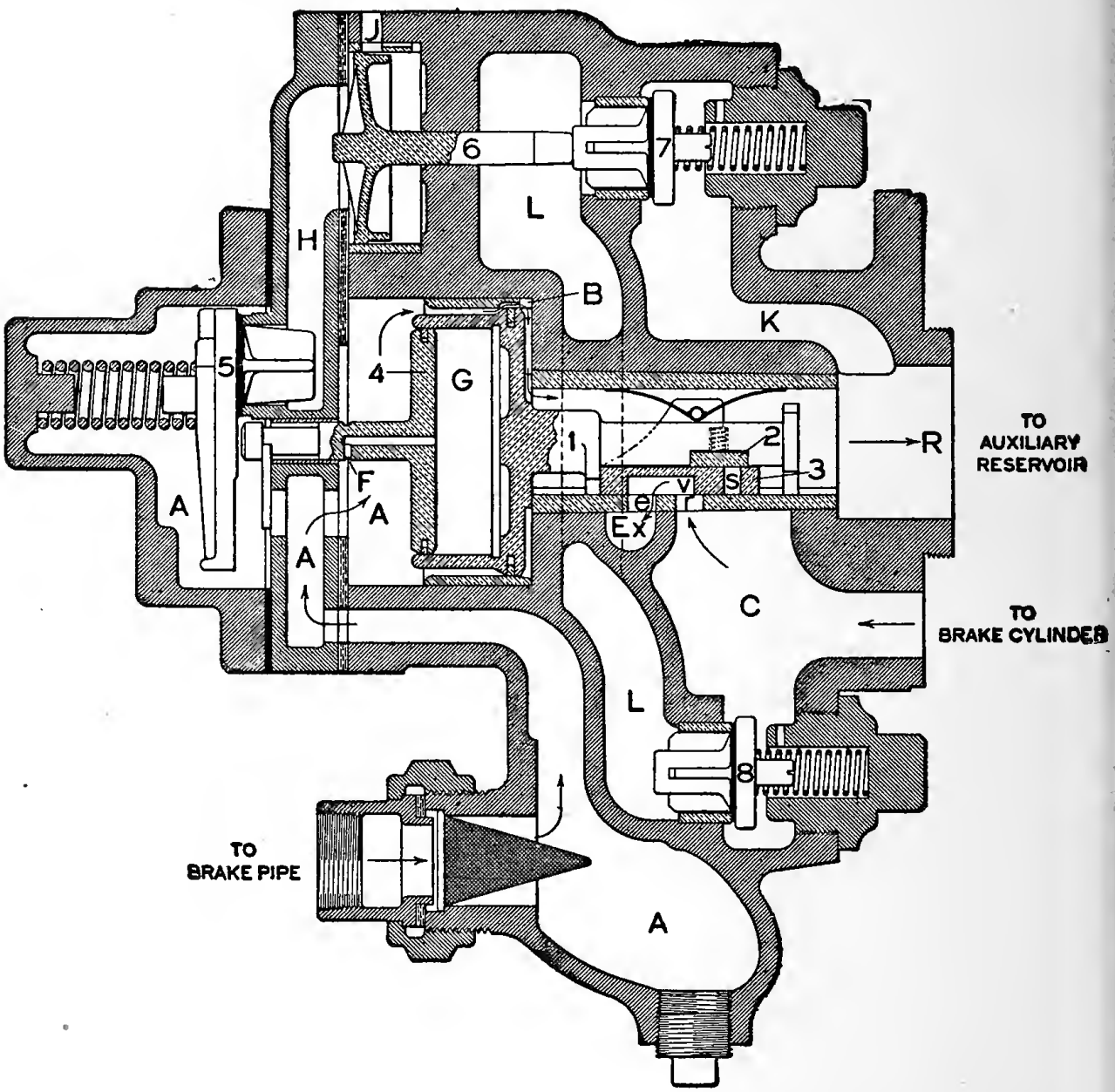


Fig. 27.—Release Position.

NEW YORK QUICK ACTION TRIPLE VALVE.

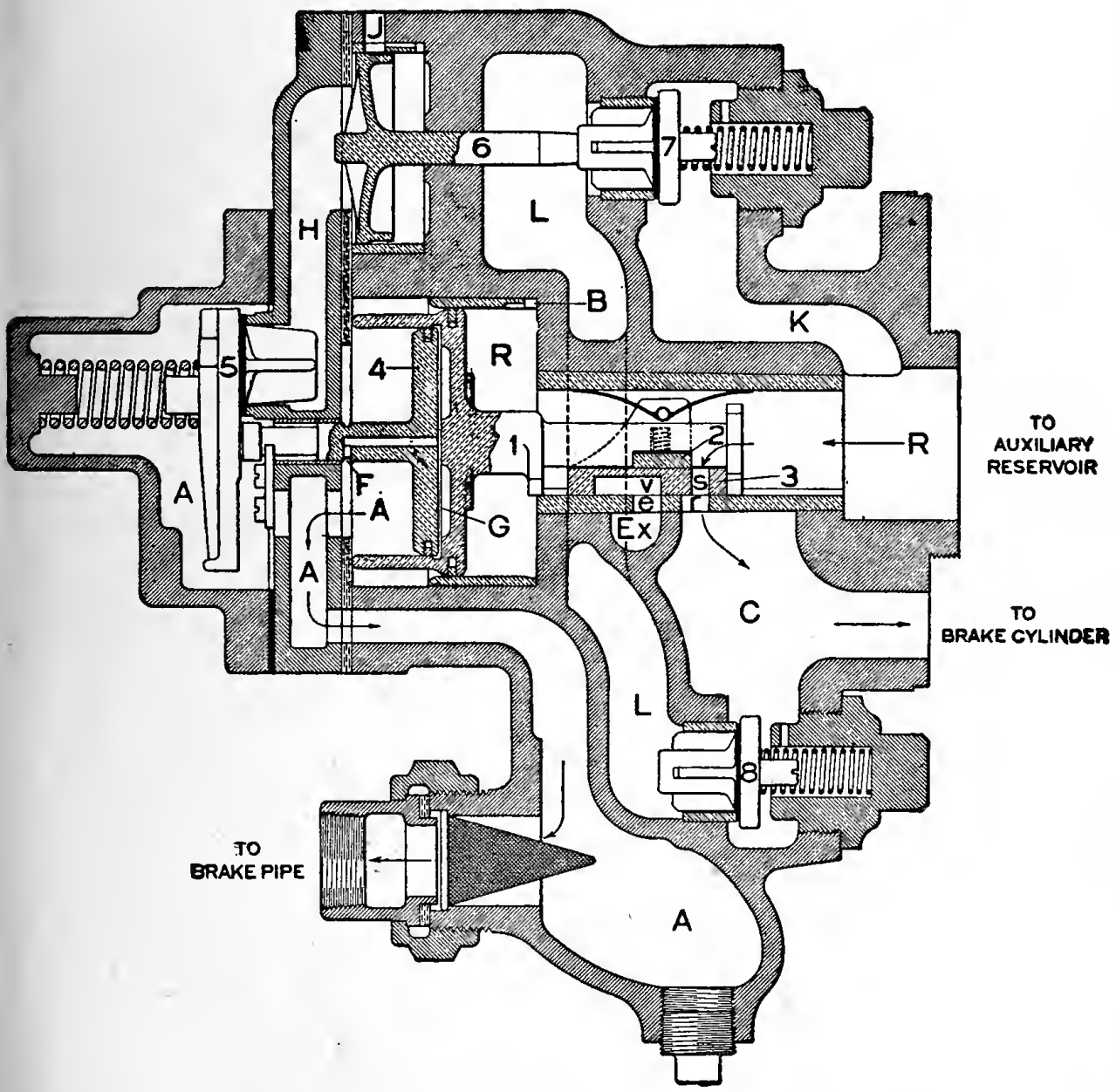


Fig. 28.—Service Application Position.

NEW YORK QUICK ACTION TRIPLE VALVE.

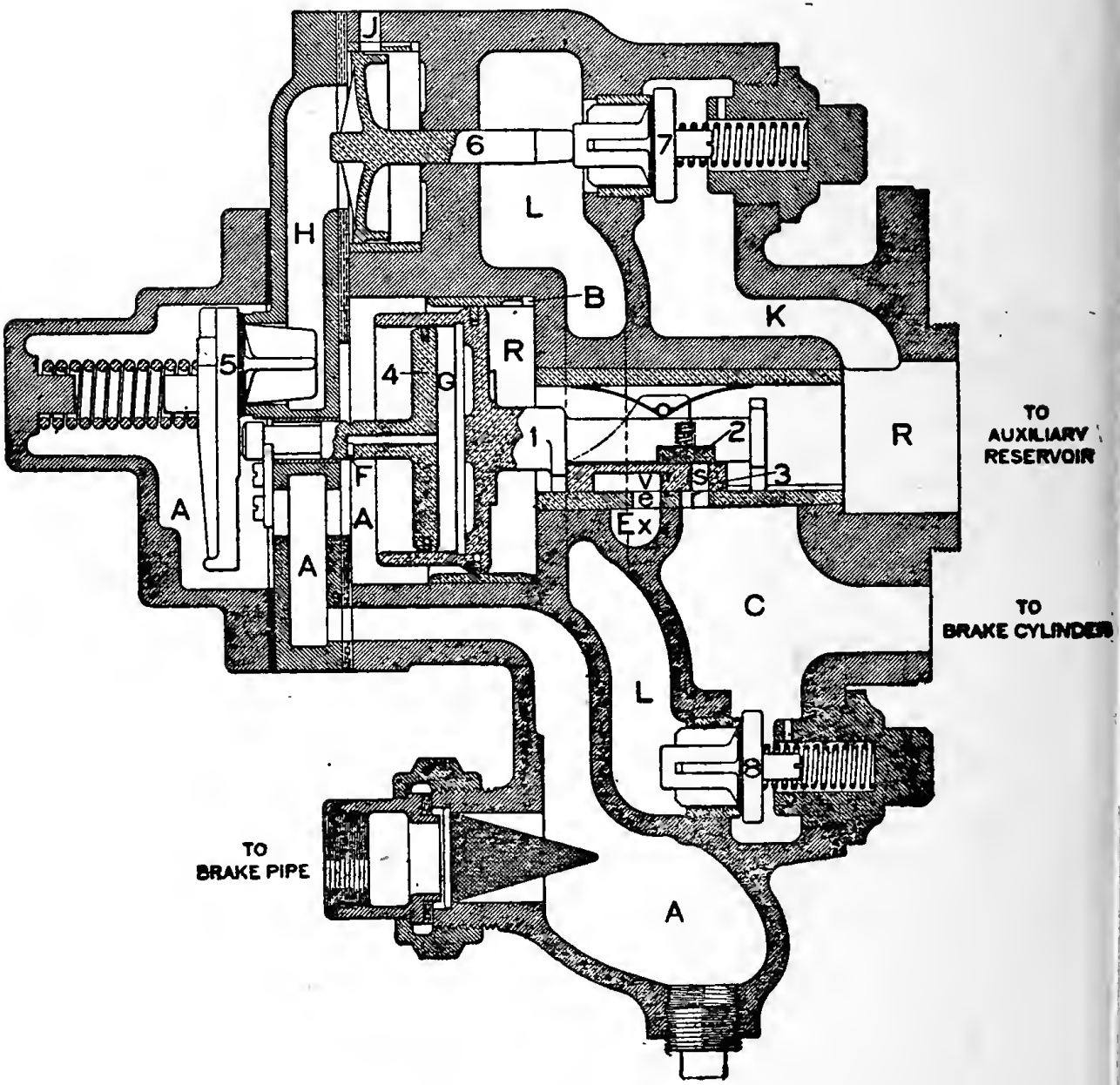


Fig. 29.—Lap Position.

NEW YORK QUICK ACTION TRIPLE VALVE.

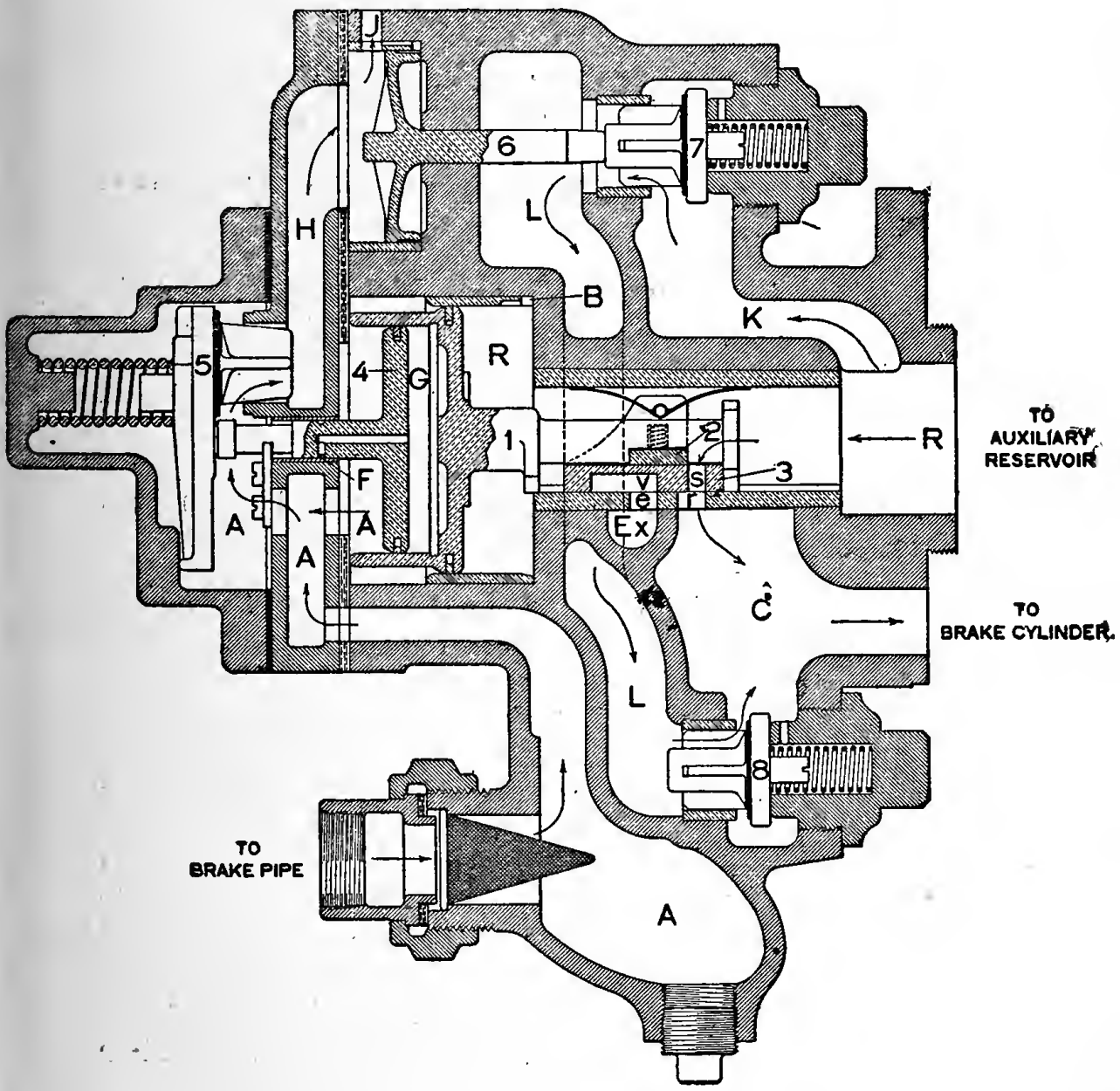


Fig. 30.—Emergency Position.

For Enginemen.

Q. What are the essential parts of the automatic air brake ?

A. The Air Pump, Main Reservoir, Engineer's Brake Valve, Brake Pipe, Triple Valves, Auxiliary Reservoirs, Brake Cylinders, Pump Governor, Air Gauge, Retaining Valves, Angle and Cut-Out Cocks.

Q. How should the pump be started? (b) and lubricated ?

A. Slowly, with waste cocks open, to allow water to escape from steam cylinder, and to accumulate sufficient pressure in main reservoir to form a cushion for the pistons. (b) The lubricator should feed about 20 drops of oil rapidly to the steam cylinder after waste cocks are closed, then cut down to about one drop per minute on an average. Oil swab on piston rod and on up stroke of piston, blow air cylinder oil cup out, close, fill with valve oil,and open on down stroke. With the New York pump, fill oil cups on top of air cylinders. Never oil through air inlets, and always use valve oil.

Q. How fast should the pump be run ordinarily ?

A. No faster than necessary to maintain the

proper pressure. If pump can have two minutes to do the work, don't crowd it into one.

Q. (a) In case the pump stops, what would you do to start it ? (b) If it started, to what would you attribute the cause of stopping ? (c) What would you do ?

A. (a) Close the starting valve, wait a moment for the steam in pump to condense, and then turn it on suddenly, also jar around steam head of pump with a block of wood. (b) If it started, would consider it stopped for the want of oil. (c) Would increase the supply of oil to steam cylinder at once.

Q. (a) In case pump stops, will the brakes apply in all cases ? (b) What is tne only way to keep informed as to whether the pump is working ?

A. (a) No. (b) By watching the air gauge.

Q. How could you detect whether the pump or the governor was to blame for the stoppage ?

A. It can be tested by opening the drain cock in the live steam passage. If pump is getting sufficient steam, would consider governor all right. If no steam reached the pump, would know governor was at fault, provided it was turned on at the boiler.

Q. How would you start a stuck governor ?

A. Would tap it lightly on the bottom to open the steam valve.

Q. (a) What causes pump to run hot ? (b) What should be done with a hot pump ?

A. (a) Continuous high speed, working

against too high a pressure, worn packing rings in air cylinder, stuck or broken air valves, too little lift of air valves, air passages or discharge pipe partly stopped up, piston rod packing too tight. (b) Would ease up on the speed, if possible, and reduce the pressure; after cooling a little, oil the air cylinder and swab on the piston rod with valve oil.

Q. (a) If a pump makes a quick stroke one way and a slow one the other, where is the trouble likely to be? (b) How could it be located quickly which end is causing the trouble?

A. (a) In the air valves. (b) The defective end usually has no suction.

Q. How would you test the air valves in a 9½ inch pump?

A. Would test the discharge valves first by pumping up full pressure, then stop the pump, open the oil cup and take plug out of lower head. A defective valve or seat will cause a steady blow at the defective end. To test the receiving valves, hold the hand at air inlet. If valve was stuck shut, no air would be taken in as piston moved away from it. If stuck open, air would be blown out as piston moved towards it, although some of it will go in with incoming air to the other end of cylinder. The piston will always move quicker towards a defective receiving valve and slower towards a defective discharge valve.

Q. How would you test for worn packing rings in air cylinder?

A. Run pump slowly against full pressure, open oil cup and hold finger over it. If air blows out on down stroke, the rings leak, pro-

vided there was no blow when the pump was at rest.

Q. (a) Would worn packing rings cause an unequal stroke ? (b) Why not ?

A. (a) No. (b) Because the air would blow by as much on one stroke as the other.

Q. (a) From the pump, where does the air go first ? (b) What are the sizes of the main reservoirs ? (c) Why does a freight engine require a larger one than a passenger engine ?

A. (a) Through the discharge pipe to the main reservoir. (b) From twenty to seventy thousand cubic inches. (c) Because there is a longer brake pipe and more auxiliary reservoirs to charge.

Q. (a) What is the name of pipe between pump and main reservoir ? (b) What is the pipe called between the two main reservoirs ? (c) What is the name of the pipe leading from main reservoir to brake valve ?

A. (a) Discharge pipe. (b) The equalizing pipe. (c) The supply pipe.

Q. Where does the main reservoir pressure start and end ?

A. It starts at the discharge valves in pump and ends at engineer's brake valve.

Q. What main reservoir pressure is usually carried ?

A. From 90 to 130 pounds, according to what service engine is in.

Q. If the main reservoir was small, which

will it effect the most, setting or releasing the brakes ?

A. Releasing the brakes.

Q. How often should the main reservoir be drained ?

A. At the beginning and end of each trip, or at least daily, especially in cold weather.

Q. How would you test for a main reservoir leak ?

A. Would pump up full pressure, lap the brake valve, stop the pump and watch the red hand of air gauge.

Q. What other equipment is operated by main reservoir pressure ?

A. The air signalling system, the straight air brake, bell ringers, sanders, cylinder cocks, ash pan slides, etc.

Q. What valve does the main reservoir pressure pass through to get into the brake pipe ?

A. The engineer's brake valve.

Q. (a) What is the standard brake pipe pressure ? (b) Where does it start and end ?

A. (a) Seventy pounds. (b) It starts at the brake valve and ends at the last angle cock, and the plain side of every triple valve piston, that is cut in.

Q. (a) Where does the auxiliary reservoir pressure begin ? (b) What is the standard auxiliary reservoir pressure ?

A. (a) On the slide valve side of the triple valve piston. (b) Seventy pounds.

Q. (a) What is the brake pipe connected to under a car or engine ? (b) What else is the triple valve connected to ?

A. (a) The triple valve. (b) The auxiliary reservoir, brake cylinder and pressure retaining valve.

Q. (a) Where is the pressure stored that applies the automatic brake ? (b) Where does it draw its air from, direct ?

A. (a) In the auxiliary reservoirs. (b) The brake pipe.

Q. (a) How long does it take to charge an auxiliary reservoir from zero to 70 pounds ? (b) How long from 50 to 70 pounds ?

A. (a) About 70 seconds. (b) About 35 seconds.

Q. (a) What is the difference between main reservoir and brake pipe pressure called ? (b) Where is it stored ? (c) Does it increase as we apply the brake ?

A. (a) Excess pressure. (b) In the main reservoir. (c) Yes, it does.

Q. (a) With a Westinghouse brake valve, what controls the main reservoir pressure? (b) What controls the brake pipe pressure?

A. (a) The pump governor. (b) The feed valve attachment.

Q. With the B or " B-1 " or the older style New York Brake Valve, what governs the brake pipe pressure ?

A. The pump governor.

Q. What regulates the main reservoir pressure with brake valve in running position ?

A. The excess pressure valve and spring.

Q. What controls the main reservoir pressure while brakes are applied ?

A. The other regulating top of the pump governor.

Q. With the "B" 3, or new Style New York Brake Valve, what governs the brake pipe pressure ?

A. The Duplex pressure controller.

Q. What regulates the main reservoir pressure ?

A. The pump governor.

Q. Some engines are equipped with three governor tops. What is the third one for ?

A. With the triplex governor two tops are connected to the brake pipe pressure. One is adjusted for 70 pounds pressure ; the other is set for a higher brake pipe pressure. The third top is connected to the main reservoir and set for the desired pressure. There is a cut out cock in the pipe leading to the low pressure brake pipe governor, which can be closed when necessary to carry a higher brake pipe pressure. As there is but one main reservoir top, it must be readjusted when necessary to change the main reservoir pressure.

Q. How should the New York Pump governor be adjusted when using two tops ?

A. The pump should be started with the brake valve on lap and adjust the main reservoir top first. Then stop the pump and reduce main reservoir pressure to about 60 pounds; place the brake valve in release position, start the pump and adjust the brake pipe governor.

Q. How adjusted when using three tops?

A. Adjust the main reservoir top first, with the brake valve in lap position. Stop the pump and reduce main reservoir pressure to about 60 pounds. Place the brake valve in release position and start the pump and adjust the low pressure brake pipe top. Then close the cut out cock in the pipe leading to it, and adjust the higher brake pipe top.

Q. If pump should stop with less than standard pressure, how could you tell if pump or governor was at fault and what would you do?

A. Would see if pump was getting steam. If not, governor is at fault. If screwing down a turn or two on adjusting nut does not allow pump to start, would take the regulating part off and clean the pin valve of a Westinghouse or the diaphragm of a New York. There should be no blow of air at the vent port until the governor stops the pump at the desired pressure, and if there was a blow, it always indicates that the governor has shut off the steam supply to the pump. Where there is more than one top, the one that is blowing does not always indicate the one that is operating, as one vent port serves for all tops, therefore examine each one until the trouble is located.

Q. (a) How many positions has the engineer's automatic brake valve? (b) In what position should it be carried with brakes off?

A (a) Five. (b) Running position.

Q. (a) How long should it be left in full release position when releasing brakes on an ordinary passenger train, either a Westinghouse or a New York Brake Valve? (b) How long on a freight train?

A. (a) About four seconds. (b) With a Westinghouse valve until the gauge hands had settled back together. When they start up, return valve handle to running position. With a New York valve, until just before the pump stops.

Q. What will be the effect if either valve is left in release position too long on a passenger train before coming to running position with a brake pipe not perfectly tight?

A. The brake pipe will be overcharged with either a Westinghouse or New York B-1 "old style" valve, and brakes will apply.

Q. (a) What effect on a long freight train with a Westinghouse valve? (b) What effect on a long freight train with a New York valve?

A. (a) The freight train would, in time, overcharge. (b) No effect except failure to pump up the excess pressure as the governor would stop the pump at 70 pounds brake pipe pressure.

Q. Why would we overcharge the short train and not the long one with the New York Brake valve?

A. If, when releasing brakes, the main reservoir and brake pipe pressure equalize above 70 pounds, due to the short brake pipe, it is overcharged, while with a long brake pipe the press-

ure equalizes below 70 pounds, due to the larger space to fill, and the pump governor will stop the pump when the standard brake pipe pressure is pumped up. Therefore, it is a question of raising the brake pipe pressure above 70 pounds on a short train with what pressure there was already in the main reservoir.

Q. (a) What would you do in case you did overcharge with train standing? (b) What would you do with the train running?

A. (a) Would make an application of the brakes and draw the pressure down below 70 pounds, then release and return handle to running position before getting 70 pounds. (b) I would make an application, if possible, without stalling. If not, place handle in release position until such time as you can make an application and work the pressure down. In stopping with the high pressure, care should be taken not to apply brakes hard, as wheels may be slid, due to the high pressure.

Q. How long should the brake valve be left in release position with a lone engine?

A. Only an instant. Return it to running position before taking the hand off the handle.

Q. (a) After brakes are properly released, should handle again be placed in release position on a passenger train? (b) What if a long freight train?

A. (a) No. (b) When returning handle to running position, after waiting a moment, again place handle in release position for a second or two and then return to running position and leave it there until you have occasion to again apply the brakes.

Q. With the Westinghouse Brake Valve in running position, if black hand of gauge registers more or less than 70 pounds, what needs regulating ?

A. The feed valve attachment.

Q. If red hand does not indicate the proper excess pressure, how do you proceed to get it with a Westinghouse Brake Valve ?

A. By adjusting the pump governor.

Q. (a) If pump was working, but did not seem to hold the pressure up and the brakes commenced to drag, etc., what would you do ? (b) What would you look for in very cold weather ?

A. (a) Would lap the brake valve. If red hand of gauge goes up, the leak is in the brake pipe. If it does not, examine the piping between pump, main reservoir and brake valve, also see if air is not turned on some of the other appliances operated by air. (b) The air strainer on pump frosted over.

Q In making a terminal test of train how could you test the amount of leakage in the brake pipe ?

A. By making an application of the brake, which will close communication between the brake pipe and the auxiliary reservoirs, and noting the fall of the black hand on the gauge per minute.

Q. How do you test for a leak in the signal line on the engine ?

A. By closing the cut out cock in, or next to

the reducing valve. A leak will cause the whistle to blow.

Q. (a) How many steam valves in a 9½ inch pump ? (b) What comprises the valve motion of the New York pump ?

A. (a) Three. (b) Two plain D slide valves; two reversing rods and two reversing plates.

Q. What are the dimensions of the cylinders of a New York No. 5 air pump ?

A. The two steam cylinders are 8x12 inches. The high pressure air cylinder is also 8x12 inches. The low pressure air cylinder is 12x12 inches.

Q. Is this a compound pump in both the steam and air end, or in the air end only ?

A. In the air end only.

Q. Describe the operation of the air end of the pump ?

A. The large cylinder compresses the air into the small cylinder and the small one compresses it into the main reservoir.

Q. What is gained by compounding the air end ?

A. It produces three cylinders of air by using two cylinders of steam.

Q. Describe the operation of the steam end of the pump ?

A. The piston in each steam cylinder operates the reversing rod, that moves the slide valve for admitting and exhausting steam to and from the other cylinder.

Q. How is this accomplished ?

A. By locating the slide valve for the right steam cylinder in the valve chamber under the left cylinder, and the slide valve for the left steam cylinder in the valve chamber under the right cylinder, and by crossing tne steam ports leading to each end of each cylinder.

Q. Do both pistons move at the same time ?

A. No. After one piston makes a stroke, it must wait until the other one completes its stroke before steam can be admitted to the other cylinder.

Q. What defect in the steam end would cause pump to run very slow?

A. The copper cylinder head gasket leaking between the steam ports, allowing live steam to leak into the exhaust end of the cylinder.

Q. What defect in the steam end will stop a New York Pump ?

A. A broken reversing rod or a reversing plate loose on the piston, also lack of oil.

Q. If, when admitting steam to a New York Pump, the low pressure piston moves up and stops at the upper end of the cylinder and the high pressure piston fails to move, where should the trouble be looked for ?

A. In the steam cylinder of the low pressure side. The reversing rod is probably broken, or the reversing plate is loose on the piston.

Q. What would be the effect if the reversing rod was broken, or the reversing plate loose on the high pressure side ?

A. Both pistons would make the up-stroke and remain there.

Q. (a) Which air cylinder of a New York Pump requires the most oil ? (b) Why ?

A. (a) The smaller, or high pressure one. (b) On account of the higher pressure and temperature which that piston works against.

Q. What is the cause of the pump not exhausting square, or working lame ?

A. A stuck or broken air valve, or if they have not the proper lift.

Q. How would you locate a defective air valve in a New York Pump ?

A. The piston will move quickly toward a leaky or broken receiving valve, and away from a broken or a leaky discharge valve. If in doubt as to which valve is causing the trouble, report them all examined.

Q. (a) How many air valves has a Westinghouse 9½ inch pump? (b) What is their lift? (c) How many air valves in a New York No. 5 Pump? (d) What lift?

A. (a) Four. (b) 3-32's. (c) Eight. (d) 3-16's.

Q. In case of a broken discharge valve, with a Westinghouse 9½ inch pump, or a broken low pressure receiving, or intermediate or final discharge valve, with a New York No. 5, what could be done?

A. If a Westinghouse 9½ inch pump replace the broken valve with the upper receiving valve. If a New York No. 5 pump, replace with the up-

per high-pressure receiving valve, then block the passage closed where valve was removed.

Q. How could you test the air gauge by means of the brake valve?

A. With the brake valve in the release position the main reservoir and brake pipe pressures are directly connected. If both gauge hands do not indicate the same, one or both hands are out. With the New York "B" 3, or new style brake valve, test before getting 70 pounds.

Q. How could you test the signal line pressure ?

A. Would pump up the pressure, stop the pump and open the drain cock on the main reservoir ; then watch the red hand of gauge. When whistle blows, the red hand indicates a little less pressure than the signal line is carrying, as the signal line pressure is then flowing back into the reservoir, thus causing a reduction of signal line pressure.

Q. (a) In case the train broke in two, or a hose burst, what would you do ? (b) If a burst hose, how could you help the trainmen to locate it ?

A. (a) Close the throttle and lap the brake valve as soon as discovered. (b) By placing brake valve in running position after train stops.

Q. (a) What is the little reservoir used for that is connected to the Westinghouse Brake Valve ? (b) What would you do if it got broken off ? (c) What is the purpose of the little reservoir in the roof of cab connected to the New York Brake Valve ? (d) What pressure charges it ?

A. (a) To increase the volume of air over the equalizing piston so that the reduction in making a service application can be made sufficiently gradual. (b) Would plug the pipe and the angle fitting in brake valve, and then brake carefully in the emergency position. (c) It holds the air that automatically laps the brake valve in making a service application. (d) Brake pipe pressure.

Q. With a New York Brake Valve, if the pipe leading to the little reservoir got broken off, what would you do ? How would you operate the brake valve ?

A. Would plug the pipe and use valve in service position as before, and lap it by hand when gauge shows necessary reduction.

Q. What would be the effect if they or their connections leak with either brake valve ?

A. The brake would apply harder than intended in making a service application.

Q. (a) With a broken brake pipe on the tender, how could the train brakes be operated? (b) If the brake pipe on the engine was broken, can the train brake be operated? (c) How?

A. (a) By coupling the signal pipe of the tender to brake pipe of engine and train. (b) In some cases. (c) If the pipe was broken back of the connection to the brake valve, plug the broken pipe, couple the brake pipe and signal pipe together on front end of the engine, and the signal pipe of tender to brake pipe of train, then cut out the signal reducing valve.

Q. If, with the Westinghouse Brake Valve in release or running position, you got a discharge

of air at the angle fitting and the brakes applied, would you look for a leak on the engine or have trainmen look for it on the train ?

A. I would look for leak in equalizing reservoir, the connections to it and in pipe to black hand of air gauge, as the pressure is reducing above the equalizing piston, thus causing the train line exhaust valve to open.

Q. What is the duty of the triple valve ?

A. To charge the auxiliary reservoir, apply and release the brake.

Q. What are the primary parts of a triple valve ?

A. A piston and slide valve.

Q. (a) What is the duty of the slide valve ? (b) The triple piston ?

A. (a) To open and close the exhaust port leading from the brake cylinder to the atmosphere and in conjunction with the graduating valve to open the port leading from the auxiliary reservoir to the brake cylinder. (b) To open and close the feed port between the brake pipe and auxiliary reservoir and to move the slide and graduating valves.

Q. (a) What pressure always moves the triple valve in a position to apply the brakes ? (b) What pressure moves the triple valve to release the brakes ?

A. (a) The auxiliary reservoir pressure. (b) The brake pipe pressure.

Q. How is the auxiliary pressure made greater than the brake pipe pressure ?

A. By reducing the brake pipe pressure.

Q. (a) If you reduce the brake pipe pressure five pounds, how much pressure will leave the auxiliary and go into the brake cylinder ? (b) If you reduce ten pounds ? (c) 20 pounds ? (d) 30 pounds. (e) Why did no more pressure leave the auxiliary after the 20 pound reduction ?

A. (a) Five pounds. (b) Ten pounds. (c) 20 pounds. (d) 20 pounds. (e) Because about a 20 pound reduction will equalize the pressure between the brake cylinder and the auxiliary reservoir.

Q. (a) How much pressure have you now in the auxiliary, brake cylinder and brake pipe ? ,b) Would a further reduction set the brake any harder ?

A. (a) 50 pounds. (b) Not if the piston travel was proper, but on account of long travel it is sometimes well to make a 25 pounds reduction.

Q. What must be done to release the brake ?

A. Allow the main reservoir pressure to flow into the brake pipe and raise the pressure above that remaining in the auxiliary reservoir.

Q. (a) How many ports in the triple valve are open when in release position ? (b) Is it possible to recharge the auxiliary without entirely releasing the brakes ?

A. (a) Two. (b) Yes, if brake has a retaining valve.

Q.(a) What effect would leaks in the brake pipe have when brakes are off ? (b) What ef-

fect would they have with brakes applied? (c) What would be the effect of leaks in the auxiliary reservoir or connection with brakes off? (d) With brakes applied?

A. (a) It would make the pump work unnecessarily. (b) Apply them harder than intended. (c) Same as leaks in brake pipe. (d) Cause them to release.

Q. What effect has a leaky graduating valve?

A. It will usually release a partly applied brake, on account of auxiliary reservoir pressure leaking into the brake cylinder, and thus reducing below the brake-pipe pressure. It would have no effect on a full set brake as the auxiliary and cylinder pressure being equal, one could not leak into the other.

Q. What pressure should you have before testing brakes?

A. Full pressure, if time will permit. At no time should this test be made with much less than full pressure. With the high speed brake full pressure must be had.

Q. Name the different positions of the brake valve?

A. Full release, running, lap, service, and emergency.

Q. (a) Does air ever blow out of the brake pipe exhaust when releasing brakes with the Westinghouse Brake Valve? (b) Why? (c) Do you hear it with over four cars?

A. (a) Yes, with a lone engine or a very short train. (b) Because the brake pipe under the equalizing piston charges faster than the

chamber above, thus raising and opening the brake pipe exhaust valve. (c) No, if so, would know there was an obstruction in brake pipe, or an angle cock closed less than four cars back.

Q. (a) When applying brakes, can you tell about how many cars of air are coupled up? (b) How?

A. (a) Yes. (b) By making a certain number of pounds reduction each time and noting the length of the brake pipe exhaust.

Q. In applying brakes, if the exhaust at brake valve was weak, what does it denote?

A. An obstruction, usually ice in the brake pipe, or an angle cock nearly closed.

Q. (a) In double heading, which engineer should control the brakes? (b) What should the other engineers do? (c) Could you tell from your cab if they were cut out or not?

A. (a) The leading, or head man. (b) Cut out their brake valves by closing the cock in the brake pipe under the brake valve and place brake valve handle in emergency position. If a New York B-3 or new style valve, also cut out straight air by closing cock in straight air pipe leading from the brake valve before placing brake valve in emergency position. (c) Yes, there would be a continuous exhaust at my brake valve when applying brakes.

Q. What effect would it have if they were not cut out when you attempted to apply the brakes?

A. The other engine would release the brakes as fast as the head man applied them.

Q. (a) What is a running test? (b) How made? (c) Should frequent use be made of this test with passenger trains?

A. (a) A test of brakes while running. (b) By applying the brakes without closing the throttle to see whether and how well the brakes take hold. (c) Yes, after leaving the terminal station or where engines have been changed, and at least one mile before reaching railroad crossings, draw bridges, etc., and before going down heavy grades.

Q. (a) In making the second application with a passenger train, how would you handle the brake valve so the brakes will respond to the first reduction of the second application? (b) Why?

A. (a) After releasing brakes, would place brake valve in lap position. (b) To prevent charging the brake pipe above the auxiliary reservoir pressure.

Q. (a) Where does all the air come from that goes to the brake cylinder in a service application with either Westinghouse or New York triple valves? (b) Where does it come from in an emergency application with Westinghouse triples? (c) Where from with New York triples?

A. (a) The auxiliary reservoir. (b) Auxiliary reservoir and brake pipe. (c) The auxiliary reservoir.

Q. (a) Can you get quick action after a partial service application with Westinghouse triple valves? (b) With New York triple valves?

A. (a) It depends on the amount of reduc-

tion already made in service and the length of piston travel. In no case can we get full emergency after making a service reduction. (b) No. After making a service reduction, quick action can not take place during the application.

Q. Why is it dangerous to apply and release the brakes repeatedly in making a station stop ?

A. Because each application decreases the auxiliary reservoir pressure and repeated applications, without recharging, will reduce the pressure so low you will have nothing left to stop with.

Q. (a) What are leakage grooves ? (b) Do you have to allow for them in setting the brakes ?

A. (a) They are small grooves three inches long,cut in the top or side of the brake cylinder at the pressure end. (b) Yes.

Q. (a) As a rule, how great a brake pipe reduction is necessary to push pistons beyond these grooves ? (b) Does a long train require more than a short one ?

A. (a)From five to eight pounds. (b) Yes.

Q. (a) How do all the angle and cut out cock handles stand both in the air brake and signalling system when open ? (b) When closed ?

A. (a) They are all open when handle is crosswise of the pipe, except the angle cock, which is parallel with the pipe. (b) When closed all are parallel with the pipe, except the angle cock, which is crosswise. If handle is missing, look at crease in the plug. It is always in line with opening through the cock.

Q. (a) How do you cut out the brake on an engine, tender, cars ?

A. By turning the handle of cut out cock straight with the pipe; the auxiliary reservoir should then be bled of all air.

Q. When you cut off from a double header where you have been operating the brake, what is your last duty ?

A. To apply the brakes. This will insure the other man cutting in his brake valve.

Q. When do you consider the most important time to look at your air gauge ?

A. After releasing the brakes, to see if the system is recharged again promptly.

Q. How do you handle the brake valve in coupling onto an uncharged train ?

A. The brake should be applied and released a couple of times before coupling on the train, to reduce the auxiliary reservoir pressure, and leave brake valve on lap until coupled on, then put in full release position for a moment, and then return to running position.

Q. (a) In testing brakes, could you tell by means of the brake valve, if they went into the emergency ? (b) How ?

A. (a) Yes. (b) By the sudden closing of the brake pipe exhaust.

Q. Should any attention be given the brake pipe exhaust when applying brakes ?

A. Yes, so as to detect any change in length of brake pipe that is cut in.

Q. (a) Should brakes be leaked on by placing valve on lap ? (b) Why ?

A. (a) No. (b) The brakes will not apply uniformly throughout the train and if they apply from the rear end first, it may cause the train to part.

Q. (a) Do you know where the emergency valve is located on the Wooten type boilers ? (b) What is it for ?

A. (a) Yes. (b) To apply the brakes in case of an emergency that the engineer was ignorant of.

Q. Which cars hold the most when the air brake is applied, loads or empties ?

A. Empties.

Q. (a) With unequal piston travel, which brakes release first, long or short travel, after making a ten pound reduction ? (b) Which after a 25 pound reduction ? (c) Why ?

A. (a) They should all release practically together. (b) The long travel brakes will release first. (c) Referring to the table on piston travel, we see that a 13 pound reduction set the 4 inch travel brake in full and it equalized at 57 pounds, but the 10 inch travel brake continued to apply harder until a 25 pound reduction of brake pipe pressure had been made. With them both fully applied there is 57 pounds pressure in the auxiliary and cylinder of the 4 inch travel brake and 47 pounds pressure in the 10 inch travel brake. To release the brakes, brake pipe pressure must be higher than the auxiliary reservoir pressure to force the triple pistons to release position and as there is 10

pounds less pressure in the long piston travel brake to overcome, it will release with 10 pounds less brake pipe pressure than the short travel brake.

Q. Can you overcharge a train with a New York B-1 or old style brake valve ?

A. We can overcharge a short train, but not a long freight train, unless, after getting excess pressure and again placing brake valve in release position. If brake pipe pressure is raised above 70 pounds it is overcharged.

Brake-Cylinder Pressure.

Service Reduction from 70 Pounds Brake Pipe.	PISTON TRAVEL.							
	4	5	6	7	8	9	10	11
	inch.	inch.	inch.	inch.	inch.	inch.	inch.	inch
7	25	23	17 ½	13	10 ½	8		
10	49	43	34	29	23 ½	19 ½	17	14
13	57	56	44	37 ½	33	29	24	20
16	57	56	54	47 ½	41 ½	35	29	24
19	57	56	54	51	47	40	36 ½	32
22	57	56	54	51	50	47 ½	44	39
25	57	56	54	51	50	47 ½	47	45
Emergency Reduction.	62	61	59 ½	58 ½	57 ½	56 ½	55 ½	55

The above table refers to either the Westinghouse or New York equipment, with the exception of the lower line, which can only be obtained with the Westinghouse Quick Action Triple Valves.

Q. (a) What is a retaining valve? (b) What is its duty? (c) With the handle turned up, how long does it take to exhaust cylinder pressure from 50 to 15 pounds?

A. (a) A valve connected to the exhaust port of the triple valve. (b) With its handle turned up, to restrict the exhaust from brake cylinder to a 1-16th inch opening, then close and retain the last 15 pounds of brake cylinder pressure, in order to keep the brakes partly applied while the auxiliary reservoirs are recharging on descending grades. (c) From 20 to 40 seconds, according to the length of the piston travel, and size of brake cylinder.

Q. If a 20 pound reduction sets the brake in full without the use of the retaining valve, how much of a reduction is necessary to fully apply the brake with the valve holding 15 pounds?

A. About 15 pounds.

For further gains due to the use of retainers see table below.

TABLE.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Piston ravel	Emergency	Emergency with Ret.	5 Lbs. Serv. Reduc.	5 Lbs. Serv. Reduc. with Ret.	Full Service	Full Serv. with Ret.
Inches	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
4	62	65	23	59	57	61
5	61	63	19	55	55	59
6	59	63	13	51	53	58
7	58	62	11	43	52	57
8	57	62	10	38	50	56
9	56	61	8	35	48	55
10	55	61	—	32	46	54
11	55	60	—	30	45	53

The above figures were obtained by taking an average of several tests for each condition.

Each test was made with the Westinghouse equipment with a brake pipe and auxiliary pressure of seventy pounds.

The first column represents the piston travel.

The second column represents the brake-cylinder pressure obtained in emergency.

The third column represents the brake-cylinder pressure obtained in emergency after the retainer has been used ; that is, there was already a pressure of fifteen pounds in the brake cylinder held by the retainer when the emergency was used.

The fourth column represents the brake-cylinder pressure obtained with a five-pound service reduction.

The fifth column represents the brake-cylinder pressure with a five-pound service reduction after once obtaining the use of the air held in the cylinder by the use of the retainer.

The sixth column represents the brake-cylinder pressure obtained with a full service reduction.

The seventh column represents the brake-cylinder pressure obtained with a full service reduction after getting the use of the retainer. — simply means that the gauge used registered no pressure less than five pounds. With a 11-inch travel the air is expanded into so large a space that a very low pressure is obtained.

The table should be read from left to right.

Q. (a) What position should brake valve be

placed in to recharge on a grade? (b) Will the pump work any faster? (c) Why?

A. (a) Full release. (b) Yes. (c) Because it will have less main reservoir pressure to work against.

Q. (a) Do you consider it your duty to open the angle cock on rear end of tender before leaving the roundhouse, especially in cold weather? (b) At what other time should this be done while on the road?

A. (a) Yes. (b) After taking water, or when the engine has been in deep snow.

Q. What would prevent the charging of an auxiliary reservoir?

A. Dirty strainers in brake pipe T, or the one in the triple valve. Feed ports stopped up, or the auxiliary may leak.

Q. Why is it necessary to have a quick action triple cut in and working next to the engine?

A. To insure quick action of the brakes on the train, if an emergency should arise.

Q. Why should there not be over two cars with brakes cut out, or with plain triples together?

A. In case of emergency, quick action may fail behind the brakes cut out.

Q. (a) What will be the effect if the vent port in pump governor is stopped up? (b) What if waste pipe is frozen or otherwise stopped up?

A. (a) After stopping the pump will be slow

in starting. (b) The pump will not stop until the air pressure was about equal to boiler pressure.

Q. (a) What effect would a leaky pin valve have on a Westinghouse Pump governor ? (b) What effect if the diaphragm leaked with the New York ?

A. (a) It would cause a constant blow of air at vent port, and if it leaked in faster than it can escape through the vent port, pressure will accumulate on top of the governor piston and force it down so as to wholly, or partially, close the steam valve. If the steam valve is closed the pump will stop. If only partly closed the pump will run slower than usual. (b) It would have the same effect as the pin valve in the Westinghouse. The remedy is, remove the spring box and clean the pin valve and seat if the Westinghouse, or the diaphragm if a New York.

Q. Why should the brake pipe pressure be just 70 pounds ?

A. The brake is designed to give the proper braking power with 70 pounds' pressure. More than this may slide wheels ; less will not give the maximum power allowed.

Q. If you were to pick up several uncharged cars, how would you handle the brake valve so as to save time ?

A. By making at least one full application and release of the brakes before coupling on to the additional cars.

Q. Explain the defects in a Westinghouse Brake Valve that cause a failure to carry excess pressure ?

A. It may be a leaky rotary valve, the lower gasket 32, the supply valve in the feed valve attachment, or the gasket between the feed valve attachment and the body of the brake valve.

Q. How could a leak in rotary valve, or the lower gasket, be distinguished from a leak in the feed valve attachment, or the gasket between it and the body of the brake valve ?

A. By placing the valve on lap, which cuts out the feed valve attachment. If the black hand moves up to the red one, the leak is either in the rotary valve or the lower gasket 32. If the black hand moves up to the red one in running position only, the trouble lies in the feed valve attachment ; usually the little supply valve needs cleaning.

Q. If the driver brake applies with the other brakes, but gradually leaks off without the triple valve popping, what would you report ?

A. A leak in pipe leading to brake cylinders, or bad packing leathers in brake cylinders.

Q. With the New York, B or B-1 old style brake valve, if you broke the pipe leading to brake pipe governor, what would you do ?

A. Would plug the pipe and if engine was equipped with a triplex governor, would adjust the other brake pipe governor top to give the proper pressure. If only a duplex governor, would adjust the main reservoir governor to 90 pounds and carry brake valve handle in running position as before. The excess pressure valve and spring will then regulate the brake pipe pressure close to 70 pounds.

Q. (a) What would you do with a Westinghouse single governor ? (b) What if pipe to either hand of gauge broke off, with either valve ?

A. (a) Would plug the pipe and regulate the main reservoir pressure by pump throttle. (b) Would plug the pipe.

Q. What are the causes of an air pump pounding ?

A. Water in cylinder ; pump loose on brackets ; worn packing rings in air cylinder, or too much lift of air valves ; stuck or broken valves; nuts loose on air piston ; or it may not reverse in time.

Q. (a) If, with the Westinghouse Brake Valve ,the pump is started with handle in release position, how will the gauge hands go ? (b) How in running position ? (c) With the New York B or B-1 or the older style Brake Valve, how would the gauge hands go in full release? (d) How when in running position?

A. (a) They will both move up together, until pump is stopped at whatever pressure the governor is set for, usually 100 pounds. (b) They will both move up together to 70 pounds, when the black one will stop, due to the feed valve attacnment closing communication between the main reservoir and the brake pipe. The red one will continue to rise until the governor stops the pump. (c) They will both move up together to 70 pounds, when the governor will stop the pump. (d) The red hand will go up 20 pounds in advance of, the black one due to the excess pressure valve and spring, and continue to rise 20 pounds apart until 90

pounds is obtained in the main reservoir and 70 pounds in the brake pipe, when the pump will stop, as the governor is operated by brake pipe pressure and adjusted for 70 pounds.

Q. In releasing brakes with the New York B-1 Brake Valve, main reservoir and brake pipe pressures equalized at 60 pounds, if handle is then brought to running position, which gauge hand will move up first and how far will it go before the other one moves ?

A. The red one. 20 pounds.

Q. (a) What should be done after coupling on to a train ? (b) How can you tell when the auxiliaries are charged ?

A. (a) Charge the brake pipe and auxiliary reservoirs. (b) The pump will about stop, or lap the brake valve and the black hand will fall if auxiliaries are still drawing air from the brake pipe.

Q. (a) What then should be done before starting out on the road ? (b) Why necessary to make this test ? (c) Should it be made at any other time ? (d) Why ? (e) If a passenger train, what is the signal to apply the brakes for test ? (f) Where given from ? (g) What is the signal to release them; where given from; why should the signal to release be given from the rear end ?

A. (a) The brakes should be tested. (b) To know before starting the train that the brakes will work properly. (c) Yes, at any time the hose has been parted, or any change in the make-up of train, except where cars are set off from rear end. (d) To prove all necessary cocks are open. (e) Four blasts of the

air signal whistle. (f) Given from the head car. (g) Four blasts of the air signal whistle given from the rear car. To prove there is communication in the signal line throughout the train.

Q. (a) If the signal line fails to charge, where would you first look for the trouble? (b) Where next?

A. (a) Would see if the reducing valve was cut in. (b) It may be frozen up or choke plug in reducing valve stopped up.

Q. If signal gives a weak blast, what may be wrong?

A. Usually the bell of the whistle needs adjusting, too low a pressure or dirt in the port under the end of signal valve.

Q. If the signal line was properly charged, what would cause it not to respond to a reduction in pressure?

(a) Usually a baggy diaphragm in signal valve, or a hole rotted through it.

Q. (a) What is the standard signal line pressure? (b) If whistle blows when brake is released, what does it indicate?

A. (a) (40 pounds. (b) Signal line overcharged.

Q. (a) How should sand be used in making a stop on a bad rail? (b) Should engine be reversed in making a stop with brakes applied?

A. (a) The rail should be sanded before brakes are applied hard. (b) No.

Q. (a) Does a New York quick action triple

valve set the brake any harder in emergency than in full service application ? (b) Why ?

A. (a) (No. (b) Because all the air that goes to the brake cylinders, either in service or emergency applications, comes from the auxiliary reservoirs, and all they can do in either case is to equalize.

Q. (a) With a New York brake valve, which service notch should be used in making the first reduction on trains of three cars or less ? (b) With five cars or more, how many notches should be used ? (c) If it fails to automatically lap, what would you do ?

A. (a) The first one. (b) Two. (c) Move the handle toward lap position to help lap it.

Q. How do you test for a leak that prevents the valve from lapping automatically ?

A. Would test the back cap of brake valve and the supplementary reservoir and the piping to it with soapy water. If not found, first make sure the slide valve is tight by placing handle in emergency position to empty the brake pipe; then in lap, to empty the little reservoir; then in one of the graduating notches to close port O; close the cut out cock and watch black hand of gauge. If it goes up, slide valve is leaking, and the two hands will equalize at main reservoir pressure. If black hand does not raise, slide valve is tight. To test for leak by piston, which would prevent valve from lapping, place valve in emergency position to empty the brake pipe, then in second service notch; close the cut out cock and watch black hand of gauge. It it goes up, there is a leak by the piston and if testing with 70 pounds' pressure, black hand will only go up to about 30 pounds. With the

"B 3" brake valve, instead of placing brake valve in emergency position to empty the brake pipe, place it midway between service and emergency positions. When testing for leakage past the piston, as in emergency position the pressure is exhausted from the chamber behind the piston, while it is not, with handle midway between service and emergency position. After exhausting the brake pipe pressure, place handle in second service notch as with the other valves.

Q. In setting brakes with the New York Brake Valve, what would you think if, after making first reduction and getting exhaust at brake valve, you got no further exhaust in the other notches; if you waited a moment or so between the reductions?

A. I would consider it was brake pipe leakage that had already leaked the pressure out, and if it had already leaked out, I certainly could not draw it out with the brake valve.

Q. What would be the result if excess pressure valve or gasket between it and body of brake valve leaked?

A. After stopping the pump would not start again until both main reservoir and brake pipe pressures reduced below the adjustmentof brake pipe governor, thus the excess pressure would be lost before pump would start again.

Q. (a) Explain how to oil the main slide valve in a New York Brake Valve? (b) How the straight air valve?

A. (a) With no air in valve, remove the plugs in the cover, place handle of automatic valve in full release. oil through back hole. then

place handle in emergency position and oil through front one. (b) Remove the plugs and oil through hole nearest the handle, then reverse handle and oil through the other one Move the valve to spread the oil. Always use valve oil and only a drop or two for each hole.

Q. (a) How much is the brake pipe pressure reduced if we use all the notches on a New York Brake Valve ? (b) Will this fully apply the brakes ?

A. (a) About 23 pounds. (b) Yes.

Q. If the pump governor became inoperative, how would you cut it out of service so pump could be regulated by hand ?

A. By placing a blind gasket in the pipe leading to it.

Q. (a) Speaking generally, what will cause brakes to apply ? (b) What will cause them to release ?

A. (a) A reduction of the brake pipe pressure. (b) An increase of the brake pipe pressure.

Q. What are the essential parts of the straight air brake ?

A. A Brake Valve, Pressure Reducing Valve, Double Check Valves and Safety Valves.

Q. What is the purpose of the reducing valve?

A. To reduce the main reservoir pressure to 45 pounds, thus regulating the brake cylinder pressure to that amount, regardless of piston travel.

Q. What is the purpose of the safety valves ?

A. If the reducing valve did not reduce main reservoir pressure properly, the safety valves should relieve the brake cylinders at 53 pounds. It is provided with a lever handle and can be used to graduate off, or entirely release the straight air or automatic brake at any time

Q. What is the purpose of the double check valves ?

A. To prevent the brake cylinder pressure escaping at the straight air brake valve, when the automatic brake is applied, or at the exhaust port of the triple valve when the straight air is applied.

Q. (a) What position should the straight air brake valve be carried in when not in use ? (b) What position should the automatic brake valve be carried in when using the straight air?

A. (a) Release position. (b) Running position.

Q. What would be the effect of applying the straight air and then the automatic ?

A. It would usually cause the wheels to slide.

Q. Why will the brake cylinder pressure increase above 50 pounds if the straight air brake is applied and then the automatic applied on top of it ?

A. Because with the auxiliary reservoir charged to 70 pounds, it will equalize with an empty brake cylinder at about 50 pounds' pressure. If the straight air is first applied, there is already that pressure in the cylinder

and 70 pounds more in the auxiliary reservoir. A light reduction of the automatic would cause a portion of the 70 pounds auxiliary pressure to go into the brake cylinder and raise the pressure there up to about 60 pounds.

Q. If the straight air brake was applied before releasing the automatic, will not the brake cylinder pressure increase so high as to slide the wheels ?

A. No. If the automatic brake was fully applied, there should be 50 pounds' pressure in the brake cylinders. The reducing valve limits the straight air pressure to 45 pounds, therefore the pressure is not increased. On the contrary, when the automatic brake is released, as soon as the pressure in the brake cylinders and in the pipe between the triple valve and the double check valve is less than that between the straight air brake valve and double check valve, the double check valve will move over and stop the escape of air through the triple valve, thus holding 45 pounds of tne automatic brake cylinder pressure. If with the automatic brake applied the brake cylinder pressure was less than 45 pounds and the straight air was then applied, it would build the cylinder pressure up to 45 pounds and retain it when the automatic brake was released until such time as the straight air brake valve was placed in release position.

Q. What defect will cause a blow at the exhaust port of a plain triple valve ?

A. A leaky slide valve, usually dirt on the seat.

Q. (a) What would cause a blow at the triple exhaust with straight air applied ? (b)

What would cause a blow at the straight air brake valve when the automatic was applied ?

A. (a) The double check valve leaking on the automatic side. (b) The double check valve leaking on the straight air side.

Q. With an engine equipped with straight air, if drivers slid when either brake was applied, how could you get the brake off the quickest ?

A. By using the lever safety valve, and placing both brake valves in release position.

Q. (a) When engine is equipped with a truck brake, if pipe leading to the brake cylinder broke off, how may the other brake cylinders be used, how would you arrange to have the proper volume of air for the other cylinders ? (b) What would be the result if you did not close this cut out cock ?

A. (a) By closing the cut out cock in broken pipe, also the cock in pipe leading to the auxiliary that supplied the disabled cylinder. (b) There would be too great a volume of air for the other cylinders and it would be liable to slide the wheels.

Q. What may result if relief port in the bottom of a Westinghouse High Speed reducing Valve got frozen or otherwise stopped up ?

A. The valve would not operate if there was any leakage of air, into the spring box, and would result in wheels sliding.

Q. What is the object of equipping a freight engine with a duplex pump governor when using the Westinghouse brake valve ?

A. To provide a means by which a high main reservoir pressure can be obtained with which to release and recharge the brakes without it being necessary for the pump to work against this high pressure, except during the time the brakes are applied.

Q. Of what does the duplex governor consist ?

A. Of Two Regulating Tops which operate in conjunction with one steam portion of the governor.

Q. At what pressure should the Tops be adjusted for ?

A. The low pressure one at 90 pounds and the high pressure one at 110 pounds.

Q. (a) With the brake valve in running position, at what main reservoir pressure will the pump stop? (b) At what pressure in any of the other positions? (c) Why?

A. (a) 90 pounds. (b) 110 pounds. (c) The 90-pound top is connected at the brake valve to a port which in running position contains main reservoir pressure. With the valve in this position, the pump will, therefore, stop at 90 pounds. With the brake valve in the other positions, this port contains less than main reservoir pressure, therefore the governor has not enough pressure to operate it; the pump will accordingly run until stopped by the other governor top which is connected to the main reservoir pressure at all times.

Q. Should both the vent ports in the governor be plugged when using the duplex ?

A. No. one should be open, the other closed.

Q. With the brake valve handle in release position, main reservoir and brake pipe pressures equalized, if red hand showed more than the black one, where is the trouble ?

A. The gauge is out of order, as the pressures are equal in full release position. This does not apply to the New York B-3, or new style Brake valve, after the pressure raises above 70 pounds.

Q. (a) If you cut out your engine or tender brake, should the auxiliary be bled of all air ? (b) Why ?

A. (a) Yes. (b) To prevent it applying due to leakage between triple valve and cut out cock.

Q. What may prevent the automatic oil cups from feeding the air cylinders of the pump ?

A. The feed port in center post being stopped up.

Q. How would you test the main slide valve for leakage in the New York Brake Valve ?

A. The pump should be started with brake valve in lap position. If black hand rises, the slide valve is leaking, or, if the pressure is already pumped up, place handle of valve slowly into the emergency position. After emptying the brake pipe, place handle in lap position to empty the supplementary reservoir, then in one of the graduating notches to close port O, and close the cut out cock. If the black hand rises, the slide valve is leaking.

Q. Some governors have a heavy flow of steam from waste pipe at all times. What would cause it ?

A. The upper seat on steam valve wants grinding in.

Q. (a) In how many positions of the brake valve can pressure go from main reservoir to the brake pipe? (b) What are they?

A. (a) Two. (b) Full release and running position.

Q. (a) What is the duty of the feed valve attachment? (b) What postion does it operate in?

A. (a) In running position of the brake valve, to reduce main reservoir pressure down to the standard brake pipe pressure, and to automatically supply brake pipe leakage, when the pressure is less than it is adjusted for. (b) Running position.

Q. Why will the brakes apply, if you leave brake valve in release position too long before returning it to running position, with leaks in the brake pipe?

A. By leaving the handle in full release position until the brake pipe is charged above what the feed valve attachment is adjusted to carry, it can not open and supply leakage until the brake pipe pressure reduces below this adjustment; thus any brake pipe leakage, if great enough, will apply brakes.

Q. How many ports are open in the brake valve when on lap?

A. They are all closed.

Q. With the slide valve feed valve and brake valve in running position, what may cause the

brake pipe pressure to rise above the standard pressure ?

A. A leaky rotary valve, lower body gasket 32, or feed valve case gasket, a leaky slide or regulating valve, either of the cap nuts leaking, the use of heavy oil, or dirt on the feed valve piston, or if the spring behind the piston is too weak.

Q. How would you proceed to clean the excess pressure valve ?

A. When there is no main reservoir pressure, remove the cap and clean the valve and seat, also the spring with kerosene, wipe dry and replace.

Q. If a continuous, though light blow is heard at the exhaust of a New York Brake Valve, when handle is in release, running or lap position, where would the trouble likely be found ?

A. The vent valve on end of equalizing piston being unseated.

Q. When releasing the brakes after an emergency application, they at first release, but some of them apply again and the black hand of the gauge keeps falling, while the pump works hard. On examining the brakes, one is found where there was a bad blow at the triple valve exhaust, what is the matter ? How would you remedy the defect and get all brakes released ?

A. The emergncy valve in a Westinghouse, or the vent valve in a New York Triple Valve is stuck open. If jarring the triple did not stop it, would cut the brake out, bleed the auxiliary and cut it in again quickly. If blow stops would

leave it cut in, if not, cut it out and bleed the auxiliary.

Q. (a) In making a service application, where do you draw the air from direct with a New York Brake Valve ? (b) Where from with a Westinghouse ?

A. (a) The brake pipe. (b) From the equalizing reservoir.

Q. How would you bleed off a brake ?

A. By opening the release valve on the auxiliary reservoir quickly, and close as soon as the triple valve exhausts.

Q. (a) In coupling engine to train already charged, which angle cock should be opened first? (b) Why?

A. (a) The one on the engine. (b) To charge the hose from the engine instead of from the train, which will set all brakes in emergency if one on car is opened first suddenly. By opening one on engine first, the brake on engine only is applied.

Q. How should all stops with freight trains be made?

A. With one application and the brake held applied until train has stopped.

Q. (a) What is an application of the brake? (b) What is meant by a reduction ?

A. (a) From the time the brakes are applied until they are released, no matter how many reductions are made, is all one application. (b) Each time the brake pipe pressure is reduced.

Q. (a) How much of a reduction should be made for the first in making an ordinary stop ? (b) After the first, how heavy should the succeeding ones be ?

A. (a) Not less than 5 pounds. (b) This depends on the length of the brake pipe and the condition of the brakes. As a rule from 3 to 6 pounds, being light with a short train and heavier with a long one.

Q. (a) Do you consider ONE or TWO application stops the best with a passenger train ? (b) Why ?

A. (a) Two. (b) It insures a greater accuracy and permits holding the brakes on until a full stop without the usual disagreeable lurch. To avoid breaking trains in two, brakes should not be released on trains of 10 cars or over while moving less than 10 miles per hour.

Q. If a stop is being made with two applications of the brake, what will be the effect of overcharging the brake pipe when releasing, after the first application ?

A. The brakes will not apply promptly, due to the brake pipe being charged higher than the auxiliary reservoirs.

Q. (a) How much pressure is carried in the brake pipe and auxiliaries with the high speed brake ? (b) How much in the main reservoir?

A. (a) 110 pounds. (b) 130 pounds.

Q. (a) How do you change the standard brake pressures for the higher pressure with the New York Brake Valve ? (b) How with the Westinghouse Valve ?

A. (a) With the B-1 brake valve, if a duplex governor is used, both regulating tops must be readjusted. If a triplex governor, readjust the main reservoir top and close the cut out cock in pipe leading to low-pressure brake-pipe governor. With the B-2 and B-3 brake valves a union three-way cock in the governor pipe is used to change the main reservoir pressure, and either a three-way, or a four-way cock in pipe between the brake valve, and the controller to change the brake pipe pressure. The handle of the cock always points to the one that is operating. (b) By closing the cut-out cock in governor pipe and turning the handle of the reversing cock around to the right.

Q. (a) At what pressure should the reducing valve or compensating valve be set, on engine? (b) on tender and cars?

A. (a) 50 pounds. (b) 60 pounds.

Q. State the advantages of the high speed brake.

A. In an emergency application, it will stop a train in about 30 per cent. less distance than the ordinary brake, as the auxiliary and brake cylinder pressures will equalize at about 85 pounds; also in making service applications the brakes may be applied twice in full and still have the same pressure for the third application as would be had for the first application of the ordinary brake. Due to the automatic reducing valves it also regulates brake cylinder pressure to 60 pounds, regardless of the piston travel in making a full application.

Q. At what pressure do the auxiliary and brake cylinders equalize when the brakes are applied in the emergency, using 110 pounds pressure?

A. About 85 pounds.

Q. What reduces this to 60 pounds, the safe pressure for slow speeds ?

A. The automatic reducing valve with the Westinghouse brake , and the compensating valve with the New York.

Q. Explain, in a general way, the operation of the automatic reducing valve ?

A. The valve consists of a piston and stem, whose downward movement is regulated by an adjusting spring. A slide valve with a triangular shaped exhaust port is attached to the upper side of the piston, which is always in communication with the brake cylinder. In a service application, if brake cylinder pressure exceeds 60 pounds, it would move the piston downwards until the large part of the triangular exhaust port was in register with a port leading to the atmosphere, and in this position it would exhaust brake cylinder pressure about as rapidly as it can enter through the service port of the triple valve, and thus prevent the cylinder pressure raising above 60 pounds. In a service application, when the cylinder pressure reduces slightly below 60 ponuds, the spring under the piston moves it up and the exhaust port is closed. In an emergency application, the pressure is flashed into the brake cylinder so suddenly that it rises to about 85 pounds and forces the piston down full stroke, in which position the small part of the exhaust port is open and a slow discharge of brake cylinder pressure takes place, while the speed of the train is high. As the pressure reduces, the spring gradually moves the piston up and the slide valve opens the triangular port wider, which reduces the

cylinder pressure faster, until, when the pressure has been reduced to 60 pounds, the exhaust port closes and the remainder of the cylinder pressure is held until released by the triple valve in the usual way.

Q. Why is a variable brake cylinder pressure desired when stopping a train ?

A. Because the friction between the brake shoes and the wheels varies with the speed, it being low at high speed and high at low speed, while the friction between the wheels and the rails remains the same, regardless of the speed.

Q. Then the braking power is the greatest at the beginning of the application, or when the speed of the train is high, and the lowest when the speed is lowest ?

A. Yes, and the size and shape of the exhaust port in the reducing valve has been determined by experiments so as to reduce the brake cylinder pressure proportionate to the reduction in speed.

Q. Explain the operations of the compensating valve.

A. In service applications, with all kinds of triple valves, it acts as a reducing valve to prevent the brake cylinder pressure increasing above the adjustment of the regulating spring. In emergency applications, with all kinds of triple valves (except the New York Quick Action), the valve gradually reduces the brake cylinder pressure from 85 pounds down to that at which it is adjusted for. In emergency applications, with the New York Quick Action Triple Valves, part of the vented brake pipe air passes from the side cap

of the triple valve into the spring box of the compensating valve and, exerting a pressure on the diaphragm in addition to the spring, prevents the valve from opening. After a few seconds the pressure of air in the spring box has become so reduced by leakage through a small hole in the check valve that the brake cylinder pressure above the piston is able to force the piston down, allowing brake cylinder air to escape until the pressure becomes reduced to that at which the valve is adjusted when the spring moves the piston up and closes the exhaust, retaining the remainder of the brake cylinder pressure until released by the triple valve in the usual way.

Q. Why is it called a compensating valve ?

A. Because in an emergency application it varies the time that the full brake cylinder pressure is held, according to brake cylinder leakage and variation in piston travel and initial auxiliary reservoir pressure. The chamber under the piston is always charged to the same pressure, about 35 pounds, so that after an emergency application there is an upward force of 60 pounds' spring pressure, plus 35 pounds' air pressure, which equals 95 pounds, total force holding the piston up. On the top or the brake cylinder side of the piston there is 85 pounds' pressure with 8 inch piston travel. The pressure below the piston must reduce 10 pounds, requiring about 8 seconds' time, before the piston can be forced downwards and allow brake cylinder air to escape. With a piston travel longer than 8 inches, equalization takes place below 85 pounds, say it equalizes at 80 pounds. With 95 pounds acting to hold the piston up, the air in the chamber under the piston will have to reduce 15 pounds before the

piston will move down and exhaust brake cylinder air. The full brake cylinder pressure is therefore held for a longer time with long piston travel than with short travel. With shorter travel than 8 inches, equalization will be higher than 85 pounds. If it should equalize at 88 pounds, the air under the piston would only have to blow down 7 pounds before the piston would be forced down, which it would do in shorter time than with longer travel. It will thus be seen that long travel brakes hold full cylinder pressure longer than short travel brakes, while short travel brakes hold it for a shorter time, thus compensating for the different travel. As brake cylinder leakage reduces the cylinder pressure it acts the same as long piston travel in lengthening the time full pressure is held in the brake cylinder.

Q. If a service application were made, reducing the brake pipe pressure 15 pounds, then a release was made, and then an emergency application was required, what would be the result ?

A. The brake pipe and auxiliary reservoirs would still contain 95 pounds' pressure. This would equalize in the brake cylinders at about 73 pounds with 8 inch piston travel and the spring box chamber would be charged with the vented brake pipe air to about the same pressure as from 110 pounds. The effect, therefore, would be to maintain the lower maximum cylinder pressure of 73 pounds for several seconds longer than the higher maximum 85 pounds had in an emergency application from 110 pounds' pressure.

Q. Why is this ?

A. Because the spring box chamber air pressure would have to reduce to a lower point before the cylinder pressure on top of the piston could force the piston down to open the relief ports.

Q. How should all stops with the high speed brake be made ?

A. With two applications. A heavy initial reduction of from 10 to 15 pounds should be made, and followed up, if necessary, with succeeding reductions to reduce the speed to about 15 miles per hour. A release should then be made by placing brake valve in release position for four seconds, then placed in lap position. A light application will then stop the train. On trains of less than 10 cars, brakes should be released just before stopping. With 10 cars or more, brakes should not be released until train has stopped.

Q. If, when making a service application with the high speed brake, they applied in undesired quick action, what would you do ?

A. I would place the brake valve in lap position until train stops and then notify the train crew, who must locate, if possible, and cut out the defective brake.

Q. If an engine not equipped with the high speed brake was to take a train so equipped, what should be done before cutting off the high speed brake engine?

A. The brake pipe pressure should be reduced to about 60 pounds. The reducing valves on engine and train will then reduce the auxiliary and brake cylinder pressure to the same amount.

Q. If a switch engine not equipped with the high speed brake was to handle a high speed brake train, what should be done ?

A. The pump governor should be adjusted to 110 pounds' main reservoir pressure and the brake valve carried in release position, being careful not to make over a 20-pound reduction when applying the brakes.

Q. How should a water stop be made with a freight train ?

A. It should be made with one application and brakes held on until train stops. The brakes should then be released and, if necessary, on account of grade, hand brakes applied, then engine cut off. The idea in releasing brakes on train before cutting engine off is, that as the auxiliaries will not be recharged, the brakes can not apply as hard the second time, (which they usually will after cutting off due to brake pipe leakage). Thus they are more readily released when engine re-couples to train.

Q. (a) If stopped on a grade, would you depend upon the air brake to hold the train any length of time ? (b) Explain why ?

A. (a) No. (b) When engine is cut off from train, hand brakes must be applied to prevent train from starting in case the air brakes leak off. As you have no way of knowing how long engine will be away from the train, so many things may occur to cause delay.

Q. How should an air brake freight train be handled on descending grades ?

A. As many retaining valves as necessary should be turned up before going over the grade and as soon as train is over, a sufficient reduc-

tion (from 7 to 10 pounds), should be made to insure getting all pistons over the leakage grooves. If necessary, follow up with succeeding reductions to reduce speed so brakes can be released to get the use of retaining valves as soon as possible. If engine is equipped with straight air, it may be applied just before releasing the automatic and the automatic valve left in full release position while recharging. If not necessary to keep straight air applied, it should be released after train brake has released. With the use of retaining valves, from a six to a ten pound reduction will usually control the train. After applying the automatic, would draw the pressure out of driver brake cylinders with the lever safety valve and allow the tires to cool while the train brake is applied. By alternating the brakes in this way, the driving wheel tires will not become overheated. Would aim to have the maximum pressure for the steepest parts of the grade and recharge in the let-ups or on the curves. The air gauge should be observed closely and remember that the usual causes of trains running away are going down the grade too fast. There should be an understanding with the trainmen, in case all retaining valves are not necessary, that they turn down a certain number if Engineer whistles off brakes, but they must not turn them down unless he does, while on the grade. If train is stopped on the grade, would not try to start until trainmen have turned as many retainers down as necessary, especially if any are turned up on empty cars.

Q. When you make the first reduction after going over a hill, if brakes do not seem to take hold properly, what would you do ?

A. Call for brakes before it is too late.

Q. (a) How heavy a reduction should be made, for the first, on a very steep grade, with from 20 to 40 cars? (b) With from 40 to 60 cars? (c) What should be waited for, after making the first reduction? (d) How heavy should the next reduction be? (e) If black hand of guage kept falling, due to brake pipe leakage, but train did not slow up, what should be done?

A. (a) From eight to twelve pounds. (b) From ten to fifteen pounds. (c) For the exhaust at brake valve to close, and to determine how well brakes were holding; also what brake pipe leakage would do. (d) From four to eight pounds, according to length of the train. (e) Hand brakes must be called for, before train gets from under control.

Q. What do you understand causes trains to get away on descending grades when being controlled by air brakes ?

A. Making too many applications without recharging the auxiliary reservoirs, or allowing the pressure to leak away because the train is running steadily. Making the first reduction too light, and trying to run the hill too fast, especially with poor brakes.

Q. (a) If engine is equipped with straight air, how would you operate it on descending grades ? (b) How long would you keep it applied ? (c) Suppose the tires were heating when using the automatic, what would you do ?

A. (a) Would apply it before releasing the automatic. (b) Just while train brake is releasing. (c) Would draw the pressure out of the brake cylinder with lever safety valve.

Q. How should all passenger train stops be made with 10 cars or more ?

A. With two applications of the brakes and the brake left applied on the second application until train stops. At the first application a heavy reduction of from 7 to 12 pounds should be made and further lighter reductions, if necessary, to reduce speed to about 15 miles per hour at a convenient place from the stopping point, then release all brakes by placing brake valve in release position for about four seconds, then place in lap position, thus making it possible for brakes to apply promptly on the first reduction of the second application. To avoid breaking trains in two, brakes should not be released on passenger or express trains of 10 cars or over when moving less than 10 miles per hour. If rail is bad, or if necessary to use sand, it should always be applied before brakes are applied hard, and its use continued until stop is made. This to avoid wheel sliding.

Q. (a) If with 10 cars or more, you misjudged and are stopping short of the intended place, if going five miles an hour or less, would you release the brakes to let the train run up ? (b) How long will you wait before trying to pull up ? (c) Why is it necessary to wait ?

A. (a) No. (b) About 10 seconds. (c) It will take this time for the pressure to exhaust from the large brake cylinders and if throttle is opened before brakes are all released, a break in two generally follows.

Q. In making a stop, is it good practice to kick off the brakes in stopping short ?

A. No, as there is no certainty as to how

many or which brakes will release. Where part do release, it tends to jerk the train and when brakes are re-applied, the ones that remained on have a tendency to slide their wheels.

Q. Explain how a service stop should be made with a part air freight train ?

A. The throttle should be closed a sufficient distance from the stopping point, and allow slack to run in. About a 5-pound reduction should then be made and again wait for slack to bunch. Then follow up with light reduction to bring train to a stop. As a rule brakes should be held on until train stops. They should be released, however, the instant of stopping, so that the brakes on air cars, will not be rigidly applied when the non-air cars run back, due to the reaction of the drawbar springs.

Q. (a) In steadying a train around a curve, where should the brake be applied ? (b) Does this apply in all cases ?

A. (a) On the straight line, just before entering the curve, and released when the speed has been sufficiently reduced. (b) No, the curve should be taken advantage of to recharge, in descending a grade, if necessary.

Q. (a) In handling a freight train, how should the application be made ? (b) If brakes are released with train moving, what precaution must be taken ? (c) Should brake valve ever be moved to release or running position while it is exhausting air ? (d) Why ?

A. (a) Sufficient time should elapse after closing the throttle to allow the slack to run in. A reduction of from five to eight pounds should then be made. The variation in piston travel,

and other conditions, will determine which way the slack will run, but either way with proper reduction, it will take place gradually. With trains partly equipped with air brakes the slack will bunch. Endeavor to keep it so until train is stopped. Hence the importance of making the stop with one application. After making the first reduction, brake pipe leakage must be taken into consideration and the succeeding reductions not made too close together. (b) The longer the train, the more liable it is to part on account of the head brakes releasing first, allowing slack to run out. Thus the safest way is to stop before trying to release the brakes on a long train, except that if engine is equipped with straight air and this brake is applied, the train brake may be released under ordinary conditions. However, the engine brake can not in all cases hold the slack. After releasing, steam should not be used until brakes have had plenty of time to release and the slack in train has all adjusted itself, then the throttle should be opened carefully. (c) No. (d) The head brakes would be releasing while the rear ones would still be applying. This is liable to part the train in several places. Always wait until exhaust at brake valve closes before releasing brakes.

Q. In backing a freight train that is only partly equipped with air brakes, how should brakes be applied ?

A. Hand brakes should be applied on the rear end to hold the slack bunched; then the air brake applied carefully to stop the train, if desired.

Q. (a) If you knew you were sliding wheels in making a stop, what would you do ? (b) How would you prevent it at the next stop ?

(c) If wheels were sliding would sand start them rotating again ?

A. (a) If possible, the brakes should be released, and before re-applying sand should be used. (b) Let the sand run before applying the brakes and continue to use it until stop is made. (c) No, and sliding on sand would cut them badly.

Q. (a) Suppose you had made a full application and were running by, should sand be used ? (b) How about it if an emergency arose ?

A. (a) No. (b) If life or property was in danger would use it, although it would be very liable to cause some badly slid wheels.

Q. (a) In case of an emergency, how should the brake valve be handled ? (b) If you had the brake already applied in service, would you go to emergency ?

A. (a) It should be placed in the emergency position as quickly as possible and left there until the train stops. The necessity of acting promptly in this case is emphasized by the fact that when running 60 miles per hour you are covering 88 feet per second. (b) Yes.

Q. (a) In case brakes are applied suddenly from the train, what would you do ? (b) Why is this done ?

A. (a) Would place the brake valve in lap position. (b) To prevent releasing the brakes and to maintain the main reservoir pressure.

Q. (a) In case a train breaks-in-two between air brake cars, what would you do ? (b) Why not try to pull out of the way ? (c) After coupling up, if the rear brakes failed to release

in any number, would it be advisable to bleed them off ?

A. (a) Close the throttle and lap the brake valve as quickly as discovered. (b) Usually you could not get a safe distance away and a short distance would only increase the shock, if they did come together. (c) No. You would not know that you have communication throughout the train.

Q. (a) What should you do to release them? (b) Why not pump them off ?

A. (a) If, when brake valve is placed in release position, the brakes do not release, would lap the brake valve and get full excess pressure, and again place brake valve in release position. This should release them, if they are cut in. (b) The slow rise of brake pipe pressure may fail to release some of the brakes, especially if any of the triple valves have worn piston packing rings.

Q. Is it necessary to make a test of the brakes after a train has been parted ?

A. Yes, in all cases, to prove that all the necessary cocks have been opened.

Q. How would you release the brakes on a freight train, if engine was equipped with the straight air brake ?

A. The straight air brake should be applied before placing the handle of the automatic brake valve in release position, and left applied until train brakes have all released. It should then be gradually released and slack allowed to run out before using steam.

Q. With the straight air applied, what might

prevent it releasing when straight air valve is placed in release position ?

A. A light application of the automatic brake, which has reversed the double check valve.

Q. What might cause the automatic brake to apply in this way ?

A. It may be caused by a leak from an overcharged brake pipe, or if no excess pressure is carried, the main reservoir and brake pipe pressures being equal, when the straight air brake is applied, it reduces the main reservoir pressure below the brake pipe; the brake pipe pressure then being the greater, flows back into the main reservoir, thus reducing the brake pipe pressure below the auxiliary reservoir pressure, which causes the triple valve to move to service position. Now as the double check valve is seated toward the triple valve, the air that goes from the auxiliary reservoir through the triple valve only has to fill up the pipe between the double check valve and the triple valve. If only a little air goes in, it builds up fast in pressure, due to the small space it occupies. Therefore, supposing the straight air brake was applied in full, the double check valve would be held over toward the triple valve with 45 pounds pressure. Now supposing there were 25 pounds pressure on the other side of the check valve, either leaked in by the double check valve, with the triple valve in lap position, so it could not escape, or put in by the triple valve. When the straight air brake was released and the pressure fell below the 25 pounds pressure entrapped between the triple valve and the double check valve, the latter would move over and close the communication from the brake cylinders to the straight air brake valve. To release the brakes under these conditions, make an application and release of the automatic brake.

Lubricants.

Q. What lubricants should be used on the different air brake parts ?

A. Steam cylinder of pump.....Valve Oil.
Air cylinder of pump.....Valve Oil.
Swab on piston rod.....Valve Oil.
Brake valve ...High Grade Machine Oil.
Triple valves and high speed reducing valves ....High Grade Mineral Oil.
Brake cylinders....A light grease that will not flow in summer or become thick in winter.

The New York Duplex Straight Air and Automatic Brake.

This brake was designed for locomotives employed almost exclusively in switching service, but which at times may be required to charge up or operate the automatic train brakes.

It consists of an Air Pump, to compress the air; a Main Reservoir in which the air is stored; a Pump Governor to control the pump, thus regulating the main reservoir pressure.

A Duplex Straight Air and Automatic Brake Valve, which is so designed that the straight air on the locomotive and the automatic on the train applies simultaneously with the same movement of the brake valve handle, either in a service or emergency application, and also releases them when the handle is placed in the release position.

A Duplex Pressure Controller, which regulates the locomotive brake cylinder pressure to 50 pounds and the automatic brake pipe pressure to 70 pounds.

A Safety Valve with a lever release, a Duplex Air Gauge, the red hand indicating the main reservoir pressure, the black hand the brake cylinder pressure, (except when operating train

brakes the Y cock, should be opened connecting the black hand of the gauge with the automatic brake pipe pressure), Brake Cylinders, Piping, Angle and Cut Out Cocks.

MANIPULATION.

When using locomotive brakes only, close the cut out cock in automatic brake pipe under the brake valve, and turn the Y cock handle to connect black hand of gauge with the brake cylinders.

When operating the automatic brakes on a train and the straight air brake on the engine, open both cut out cocks below the brake valve and turn the Y cock to connect the black hand of gauge with the automatic brake pipe, and open the ¼ inch cut out cock in pipe leading to the automatic brake pipe top of the duplex pressure controller.

To release engine and tender brakes, and not the train brakes, use lever safety valve, or close cut out cock in automatic brake pipe, and release with brake valve.

The engine and tender brakes can be cut out by closing the cock in the straight air pipe under the brake valve. This cock may be used to hold engine and tender brakes applied, if desired, when releasing the train brake at slow speeds. The tender brake may be cut out by closing cock in pipe leading to the brake cylinder.

To admit full main reservoir pressure to the automatic brake pipe for quick re-charging, close the ¼ inch cock in pipe leading to duplex pressure controller, thus cutting it out. Ordinarily this cock should be left open.

The Duplex Pressure Controller acts as a feed valve to regulate the automatic brake pipe pressure to 70 pounds, when the handle of the brake valve is in release position, and also prevents over 50 pounds pressure going to locomotive brake cylinders, when brakes are applied. It may be cut out of service, if desired, by screwing up on the hand wheel.

Q. If an engine with this equipment was to handle a high speed brake train, what should be done ?

A. The pump governor must be adjusted for 110 pounds' main reservoir pressure, and the cock closed in pipe leading to duplex pressure controller. This will allow full main reservoir pressure of 110 pounds in the brake pipe. After cutting off from the high speed brake train, open the cock in controller pipe and readjust the pump governor to 100 pounds.

Westinghouse E. T. Locomotive Brake Equipment.

Q. What does the symbol " E. T." designate?

A. It designates the Westinghouse new engine and tender brake equipment, the letters " E. T." meaning " engine" and " tender."

Q. What are the essential parts of this equipment ?

A. An Air Pump to compress the air, the Main Reservoir in which the compressed air is stored, a Distributing valve and small double chamber reservoir attached to it, placed on the engine to admit and exhaust air from the brake cylinders on the engine and tender, both in automatic and in independent applications, and to maintain the desired cylinder pressure, regardless of cylinder leakage or variation in piston travel. It also performs the function of triple valves, auxiliary reservoirs, double check valves and high speed reducing valves.

Two Brake Valves, the Automatic to operate locomotive and train brakes, and the Independent to operate locomotive brakes only.

A Duplex Pump Governor which automati-

cally shuts off the supply of steam to the pump when the desired air pressure is obtained in the main reservoir, and which allows steam to again reach the pump when the air pressure falls below this amount.

A Feed Valve to regulate the brake pipe pressure when the automatic brake valve handle is in either running or holding position.

A Reducing Valve to reduce the main reservoir pressure for the Independent Brake Valve, and for the air signaling system, when used.

Two Duplex Air Gauges; one, to indicate equalizing reservoir and main reservoir pressures; the other, to indicate brake pipe and brake cylinder pressures.

Brake Cylinders, Cut-Out Cocks, Air Strainers, Piping, Hose, Couplings, etc.

Q. Why are stop cocks located in the pipes leading to brake cylinders ?

A. To cut out any one or all of the brakes for any cause.

Q. What is the Standard Brake Pipe pressure carried with this equipment ?

A. 70 pounds for the ordinary brake, and 110 pounds for the high speed brake.

Q. What main reservoir pressure is carried with this equipment ?

A. About 20 pounds higher than the brake pipe pressure until the automatic brake is applied. Then the main reservoir pressure should increase up to 130 pounds.

Q. What regulates the brake pipe pressure

when the automatic brake valve handle is in running or holding position ?

A. The feed valve located in the pipe between the main reservoir and the automatic brake valve.

Q. How are the pump governors regulated ?

A. With the automatic brake valve in running position, the shortest top should be adjusted to give 20 pounds of excess pressure in the main reservoir. The automatic brake should then be applied and the other top adjusted for 130 pounds main reservoir pressure.

Q. In what way does the pump governor used with this equipment differ from that used with the old brake valve ?

A. In that it automatically adjusts the excess pressure whenever the feed valve adjustment is changed from one brake pipe pressure to another.

Q. How is the feed valve adjusted for either 70 or 110 pounds brake pipe pressure ?

A. By turning the handle one way until the lug strikes the lower stop. The valve will regulate the brake pipe pressure to 70 pounds and by turning it the other way, until the lug strikes the upper stop, it will regulate the brake pipe pressure to 110 pounds.

Q. If desired to carry any other pressure, what must be done ?

A. The position of the stops must be changed.

Q. What are the plugs for in the caps of both brake valves ?

A. To oil the rotary valves. When there is no pressure in the valves, remove the plugs and fill with valve oil.

Q. (a) How many positions has the new Westinghouse H 5 or H 6 Automatic Brake Valves? (b) Name them?

A. (a) Six. (b) Release, Running, Holding, Lap, Service and Emergency.

Q. Describe the purpose of the different positions ?

A. Release position is for releasing and recharging the train brakes by opening a large and direct passage from the main reservoir to the brake pipe, but not releasing the locomotive brakes, if they were applied.

Running position is the proper one to carry handle in when the brakes are charged and ready for use, and to release the locomotive brakes.

Holding position is for holding the locomotive brakes applied, the same as in release position, while the train brake recharges. The only difference between running and holding position is that in holding position the locomotive brake is held applied, while in running position it is released.

Lap position is for holding the brakes applied after a service application, or if a conductor's valve was opened, a break-in-two, or a hose burst ; also for all engines in a train that are not controlling the brakes, if an H 5 Brake Valve.

Service position is for making all ordinary

stops, or when the brakes are to be applied gradually.

Emergency position is used when it is desired to apply the brakes as hard and as quickly as possible.

All pipes between the brake valve and the distributing valve must be positively air tight.

Q. As there are no auxiliary reservoirs used with the "E. T." equipment, where is the air taken from to apply the brakes ?

A. From the main reservoir, in either automatic or an independent application.

Q. In double heading, in order to give control of the brakes to the leading engineer, what should the second engineer do ?

A. The cut out cock under the automatic brake valve must be closed and the handle of the automatic valve placed in lap position, if the No. 5 equipment, or running position if the No. 6.

Q. If the brakes were applied from the lead engine, can the second engineer release his engine brakes ?

A. Yes, by placing his independent brake valve in release position. He could also reapply them if desired.

Q. (a) After making an application of the automatic brake, can the locomotive brake be released and re-applied with the independent brake valve ? (b) How ?

A. (a) Yes. (b) The locomotive brake may

be released by placing the independent brake valve in release position, and re-applied again by placing it in the service position, and admitting the desired pressure.

Q. As the air is taken from the main reservoir for applying the locomotive brakes, how could they be operated on the second engine in case the air pump was disabled ?

With the No. 6 equipment pressure can be supplied to the main reservoir from the brake pipe, by opening cut out cock in the by-pass pipe in under the double heading cock. Between the brake pipe and main reservoir the by-pass contains a combined strainer, check valve and choke fitting. When the cut out cock is opened the choke restricts the flow of pressure from the brake pipe to the main reservoir, and the check valve prevents the main reservoir pressure from flowing back to the brake pipe, when a reduction is made in applying brakes.

With the No. 5 equipment the main reservoir may be supplied while the train is at rest, by placing the automatic brake valve in release position, and opening the cut out cock under the brake valve. Before starting the train this cock must be closed, and the brake valve placed in lap position if the No. 5 equipment; running position if the No. 6.

MANIPULATION.

When not in use carry both brake valves in running position.

To apply the brakes on engine and train, place the handle of the automatic brake valve in the service position, making the required

brake pipe reduction, and then back to lap position.

To release the train brakes, place the handle in release position long enough to release the train brake, being careful not to overcharge the brake pipe ; then move it to holding position, gradually releasing the locomotive brakes by short, successive movements, between running and holding positions, aiming to have the locomotive brakes off as the train stops.

If a full stop is not desired, release the train brakes in release position, and, after the slack in train has adjusted itself, move the handle to running position to release the locomotive brakes.

To make a smooth and accurate two-application passenger train stop, make the first application a heavy one. When the speed has reduced to about fifteen miles an hour at a convenient distance from the stopping point, release train brakes by placing valve in release position, then pause a second or two in running position to reduce locomotive brake cylinder pressure, then lap the valve, as with the ordinary brake valve, making the second application after, as conditions require.

When using the independent brake valve carry the automatic one in running position. The independent application can then be released by placing the independent brake valve in running position.

The release position of the independent valve is for use when the automatic brake valve is not in running position.

If an emergency should arise while the inde-

pendent brake is applied, apply the automatic brake instantly. The safety valves should restrict the brake cylinder pressure to the proper amount.

In descending grades the brake on the locomotive must be alternated to prevent over-heating the driving wheel tires, and to assist the retaining valves in holding the train while recharging the auxiliary reservoirs on the train.

This can be done by keeping the engine brakes released by use of the independent brake valve while train brakes are applied, and applying engine brakes just before releasing train brakes and then releasing engine brakes before re-applying train brakes, after they are re-charged.

After all brakes are applied automatically, to graduate off, or entirely release the locomotive brakes, use release position of the independent brake valve.

The release position of this valve will release the locomotive brakes at any time.

The brake cylinder gauge should be observed closely, as it indicates at all times the brake cylinder pressure.

In case of a bursted hose, a break-in-two or a conductor's valve opened, place the handle of the automatic valve in lap position.

When there are two or more engines in a train turn the cut out cock in the brake pipe under the automatic brake valve to close the brake pipe, and the automatic brake valve handle should be placed in lap position if the H-5 Brake Valve, running position if the H-6,

on all engines, except the one that is operating the brakes.

If an emergency should arise, place the handle of the automatic brake valve in the emergency position and leave it there until the train stops.

Q. Why is the independent brake valve necessary ?

A. If desired, the locomotive brakes can be operated at any time, independently of the automatic brakes.

Q. (a) How many positions has the independent brake valve ? (b) Name them ?

A. (a) Four. (b) Release, Running, Lap and Service positions.

Q. Describe the use of the different positions ?

A. Release position is for releasing the locomotive brakes ,regardless of the position of the automatic brake valve. A spring automatically returns the handle from release to running position, as otherwise it would be impossible to operate the locomotive brakes with the automatic brake valve.

Running position is for carrying the handle in when the valve is not in use, also to release the locomotive brakes, if the automatic brake valve is in running position. It is necessary for it to be in this position for the locomotive brakes to release when the handle of the automatic brake valve is placed in running position.

Lap position is for holding the independent brakes applied, all ports being closed.

Service position is for applying the locomotive brakes independently.

Q. What is the maximum cylinder pressure obtained with the independent brake valve ?

A. 45 pounds.

Q. What regulates the cylinder pressure to this amount ?

A. The automatic pressure reducing valve, located in the pipe between the main reservoir and the brake valve.

Q. When is it necessary to use the release position of the independent brake valve in order to release the locomotive brakes ?

A. Only when the automatic brake valve is not in running position.

For Trainmen.

Q. Why should we begin at the rear end of train to get the air brakes ready ?

A. To prevent the brakes applying on the cars that are charged each time an angle cock is opened ; also an angle cock may be opened allowing all brake pressure to escape.

Q. Commencing at the rear, how do we proceed to get the air brakes ready ?

A. By closing the rear angle cock, cutting in all brakes that are in good working order, cutting out and carding all those that are not, observing that the release valves are closed, the pressure retaining valve handles turned down, (unless they are to be tested, then they should be turned up) and unless required account of grade hand brakes released, the hose coupling gaskets examined to see if they will make tight joints, the hose coupled and the angle cocks opened.

Q. What should be done before coupling the hose between engine and train ?

A. The brake pipe on the engine should be blown out.

Q. What should be done before turning the air into the train ?

A. The slack should be stretched to see if all couplings are made, also to locate any leakage due to a short hose, after the air is turned in.

Q. While the train is being charged, what should be done ?

A. The brakes should be inspected and all leakage stopped.

Q. (a) When coupling engine onto cars already charged, which angle cock should be opened first ? (b) Why ?

A. (a) The one on the engine. (b) So as to fill the empty hose from the engine and thus prevent the train brakes applying in the emergency, which they will do if the angle cock on the car is opened first suddenly.

Q. When coupling an uncharged car to others already charged, how should the angle cocks be opened ?

A. The one on the uncharged car should be opened first so the empty hose and brake pipe will be connected, then open the one on the charged car slowly.

Q. Why is it necessary to test the brakes before leaving a terminal ?

A. To know before starting the train that the brakes will apply and release properly, and not go into undesired quick action and also that the piston travel is correct.

Q. (a) At what other times should the brakes be tested ? (b) Why ?

A. (a) At any time there has been any change in the make up of the train, except where cars have been set off from the rear end, also at any time the hose has been uncoupled. (b) To prove that all necessary angle cocks have been opened.

Q. If an angle cock was only partly open how would it affect the operation of the brakes?

A. They would apply in a service application behind the partly closed cock, but would be slow in releasing. The reduction of brake pipe pressure being so gradual, quick action would fail, if an emergency should arise.

Q. (a) Can a train be made up so it will be impossible to get quick action from the brake valve? (b) How?

A. (a) Yes. (b) By having too many brakes cut out next to the engine. The head car should have a quick action triple cut in and working, and there should not be over two cars with brakes cut out, or cars equipped with plain triple valves together in the train.

Q. (a) What would cause the brakes to apply quick action when only a service reduction was made? (b) How may the defective brake be located? (c) What should be done when it is found?

A. (a) It is generally caused by a defective triple valve usually one that is simply dirty and sticky. (b) The Engineer should be asked how heavy a reduction was made before the brakes applied quick action. If he says 8 or 10 pounds have him make a 5-pound reduction and look for one that has not applied. If one is found cut it out, and have him make a second reduc-

tion. If they now work all right the one cut out, must be the one causing the trouble; to prove it cut it in, release, recharge and have them applied again; if it does not move on first reduction and goes on in the emergency on the second it is surely the one. If quick action is obtained with the first reduction, say of 5 ponuds, close any angle cock in the middle of the train ; if they still apply in quick action the trouble is in first half of train, if not it is in the rear part ; divide up again the half trouble is on until the defective one is located. (c) It should be cut out, the auxiliary reservoir bled of all air and a defect card applied.

Q. Within what limits should the piston travel be maintained ?

A. Between 6 and 8 inches.

Q. If the piston travel is too long or too short what effect does it have on the holding power of the brake ?

A. See table on piston travel on page 93.

Q. What would prevent the charging of an auxiliary reservoir.

A. Dirty strainers,either at T in cross over pipe, or the one in the triple valve, the feed port in triple valve may be stopped up, or the auxiliary reservoir may leak.

Q. Where would you look for the trouble if a brake applied properly but would not release?

A. The pressure retaining valve may be turned up, the push rod bound in the piston sleeve, or the sleeve bound in the cylinder head, levers or rods may catch on something under the car or the hand brake may be applied.

Q (a) What is the retaining valve connected to ? (b) If broken off should the pipe be plugged ? Why ? (c) If broken off will the brake apply and release properly ?

A. (a) The exhaust port of the triple valve. (b) No, after the brake was applied it could not release. (c) Yes.

Q. How are retaining valves tested ?

A. The handles should be turned up either before or after the brakes are applied. The brakes should then be released and after air ceases to discharge from the retainer the handle should be turned down ; if a blow accompanies the turning down of the handle it is working properly, if not it has leaked off.

Q. When using retaining valves what may be the result if the 1-16th inch exnaust port in the bottom was stopped up ?

A. It would retain all brake cylinder pressure when the brake was released and be liable to overheat the wheels and cause them to break.

Q. There is a large three position retaining valve used on some heavy cars, how does it operate ?

A. When the handle points downward all brake cylinder pressure escapes freely to the atmosphere ; when the handle is turned half way up, it retains 50 pounds' pressure in the cylinder when the brake is released ; when the handle is turned horizontal it retains 25 pounds.

Q. Will a retainer hold more pressure on a long or a short piston travel brake ?

A. It holds the same amount of pressure in either case the volume of air is greater on the long travel brake.

Q. (a) At which end of the train should the retainers be turned up from ? (b) Which end in turning them down ? (c) Why should they be turned down from the rear end ?

A. (a) The head end. (b) The rear end. (c) To prevent the slack running out of the train which may result in a break-in-two.

Q. What would be the effect of starting a train with the retainers holding, especially on empty cars ?

A. It would be liable to slide the wheels.

Q. (a) How should the angle cock handles stand when open ? (b) How does the cut out cock handle stand when open ?

A. (a) In line with pipe. (b) Crosswise to the pipe.

Q. If the handle was missing or possibly put on wrong how could you tell if cock was open or closed ?

A. A crease in the top of the plug is always in line with the opening through the cock.

Q. (a) On a passenger train where should the signal be given from to apply the brakes ? Why ? (b) Where given from to release them ? Why ?

A. (a) From the head car, so as to hear if the whistle on the engine blows, also to communicate with the engineer if necessary. (b)

From the rear end, to prove there is communication in the signal line throughout the train.

Q. What is the signal for applying or releasing the brakes ?

A. Four blasts of the air signal whistle.

Q. How should the signal cord be pulled to transmit proper signals to the engine ?

A. It should be pulled directly down, for one second and allow three seconds to elapse between each pull.

Q. What would prevent the signal responding from one car and operate from all others ?

A. The cut out cock being closed under the car discharge valve, a dirty strainer in the T where the branch pipes joins the main signal pipe, or the car discharge valve may not open a sufficient amount to cause a sudden enough reduction in signal line pressure.

Q. If on a passenger train the Engineer whistles for brakes, what must be done ?

A. The Conductor and each trainman should open a Conductor's Valve first, and then apply the hand brakes.

Q. In the event of a burst hose on a passenger train and there was no extra one on the train, what could be done ?

A. Remove the one on rear end of last car or the one on the front end of the engine.

Q. What should be done with a car in a passenger train that has a broken brake pipe ?

A. It depends on conditions, air may be made to pass through it by coupling the brake pipe of the other cars to the signal pipe on the car with the broken brake pipe; this will do away with the signal on all cars in the rear, but will make all the brakes operative except the one with the broken pipe, or it way be placed on the rear end, provided its hand brake is in good order.

Q. When such a car is placed in the rear, what precaution must be taken ?

A. Its hose must be coupled to the car ahead and all angle cocks opened except the one on front end of the car with broken pipe. If hand brake was out of order the car must be placed second from the rear end, the rear car must have a hand brake in goor order and a man on it to handle brake at all times.

Q. When hand brakes are necessary on a part air brake train where should they be applied ?

A. Immediately behind the air brake cars.

Q. In backing a freight train only partly equipped with air brakes where should hand brakes be applied ?

A. At the rear end.

Q. If stopped on a grade how should hand brakes be applied ?

A. If on a descending grade brakes should be applied on the head end ; if on an ascending grade brakes should be applied on the rear end.

Q. When setting out a car what should be done ?

A. The brakes should first be released, the angle cocks closed on each end of the brake pipe where hose is to be parted and the hose parted by hand, the auxiliary reservoir bled of all air and after car is placed on the siding the hand brake applied.

Q. Why not set the hand brake before releasing the air brake ?

A. On some cars it would be set too tight and may break the chain when the air pressure on the piston was released, on others it would not be set at all.

Q. What is the proper way of releasing a brake with the release valve ?

A. It should be opened until air commences to escape at the exhaust of triple valve, when it should be closed. If it is held open longer it may apply other brakes.

Q. (a) Where is the pressure stored that applies the automatic brake ? (b) Where does it draw its air from direct ?

A. (a) In the auxiliary reservoir. (b) The brake pipe.

Q. What is the duty of the triple valve ?

A. To charge the auxiliary reservoir, apply and release the brake.

Q. How long does it take to charge an auxiliary reservoir from zero to 70 pounds ?

A. About 70 seconds.

Q. When charged up and ready to apply the brakes how does the pressure in the auxiliary reservoir, and the brake pipe stand ?

A. They are equal.

Q. What has to be done to apply the automatic air brake ?

A. Reduce the brake pipe pressure, which reduction causes the triple valve to move and allow the auxiliary reservoir pressure to flow into the brake cylinder.

Q. When the brake is fully applied how do the pressures in the auxiliary reservoir and brake cylinder stand ?

A. Equal.

Q. How much would it be necessary to reduce the brake pipe pressure to accomplish this ?

A. About 20 pounds.

Q. What must be done to release the brake ?

A. The brake pipe pressure must be made stronger than the remaining auxiliary reservoir pressure, that it may force the triple valve to release position against that pressure; in so doing the communication between the auxiliary reservoir and brake cylinder is closed, the exhaust port between the brake cylinder and atmosphere is opened, also the feed port between the brake pipe and the auxiliary reservoir.

Q. How is the brake pipe pressure made the stronger ?

A. By either admitting air from the main

reservoir into the brake pipe, or decreasing the auxiliary reservoir pressure by the release valve.

Q. What position must the triple valve be in to recharge the auxiliary ?

A. Release position.

Q. Can the auxiliary reservoir be recharged without entirely releasing the brake ?

A. Yes, by turning up the retaining valve handle.

Q. What effect has leaks on the operation of the brakes ?

A. If the brake pipe leaks, the brake will apply harder than the engineer intended, or until they are fully applied ; if there is a leak from an auxiliary reservoir the brake will release on that car ; a leak in a brake cylinder will allow the pressure to escape thus releasing the brake.

Q. What effect would a weak or broken graduating spring have on a Westinghouse quick action triple valve ?

A. There would be nothing to stop the triple piston when it reached service position and it would move on to emergency position.

Q. What effect would one quick action triple going on in emergency have on the other brakes ?

A. If one quick action triple valve goes into quick action it makes a sudden brake pipe reduction which starts the next triple valve, and that one the next, and so on until they are all applied.

Q. Does a weak or broken graduating spring have the same effect on a long train, as it does on a short one ?

A. No, on a long train due to the larger volume of brake pipe air the auxiliary reservoir pressure can flow into the brake cylinder faster than the brake valve can reduce the brake pipe pressure, therefore, it is not necessary to have anything to hold the triple valve in service position. The absence of the graduating stem or spring will cause quick action on short trains only.

Q. How many cars must there be in a train to prevent quick action from a broken or weak graduating spring ?

A. With over six or eight cars a triple valve with a broken or weak graduating spring would not be noticed if the triple valve was working properly otherwise.

Q. Quick action triple valves are often found where there is a blow at the exhaust port ; what would cause this ?

A. Sometimes it is dirt under the slide valve or on the seat of the emergency valve, which may sometimes be stopped by jarring the triple lightly around the emergency valve; if this does not stop it, apply the brake in quick action by parting the hose and opening the angle cock.

Q. Should this not stop it, where could the leak be if a Westinghouse triple valve ?

A. It may be due to a leaky emergency valve, a leaky check valve case gasket, a leaky slide valve, a leaky gasket between the triple valve and auxiliary on freight, or the brake cylinder

on passenger, or a leaky tube in the freight auxiliary.

Q. How can the defective part be located without taking the triple valve down ?

A. A leaky emergency valve and a check valve case gasket produce the same effect and are reached by taking the same part down. To tell if it is either of these parts, charge the auxiliary reservoir and then cut the brake out; if either of these parts are leaking they reduce the brake pipe pressure and apply the brakes ; if the brake does not apply it indicates that these parts are all right. The cut out cock should then be opened, the auxiliary reservoir recharged after which the brakes should be applied lightly ; if the blow continues after the brake is applied the slide valve is leaking as it should close the exhaust port when the brake is applied. If the blow stops when the brake is applied it is generally the gasket between the triple valve and auxiliary reservoir or brake cylinder as the case may be, or the tube in the freight auxiliary. The slide valve, the triple valve gasket, or the auxiliary tube leaking, would all reduce the auxiliary reservoir pressure and therefore have a tendency to release the brake when applied; the slide valve would leak to the atmosphere and would release the brake no matter how it was applied; the triple valve gasket or the auxiliary tube leaking would be a leak to the brake cylinder, and therefore could only release a partly applied brake, because when the brake was fully applied the auxiliary and brake cylinder pressures would be equal, therefore one could not leak into the other.

Q. If there was a blow at the exhaust port

of a triple valve or a pressure retainer would you plug the exhaust port or turn up the retainer ?

A. The exhaust port of the triple valve must never be plugged for the reason the brake could not release ; if the retainer was turned up it would also keep the brake applied ; never use a retaining valve that has a blow, if necessary use the hand brake lightly on that car.

Q. Where is the pressure stored that applies the Westinghouse quick action automatic brake in a service application ?

A. In the auxiliary reservoirs.

Q. Where does it all come from that applies it in an emergency application ?

A. The auxiliary reservoir and the brake pipe.

Q. What is the difference between cutting the air out of a car and cutting it out of a brake ?

A. Closing an angle cock at the head end of a car cuts out that car and all behind it, while closing the cut out cock in the branch pipe cuts out the brake on that car only.

Q. (a) Does the New York Quick Action Brake apply any harder in an emergency application than it does in full service? (b) Why?

A. (a) It does not. (b) Because all the air that goes into the brake cylinder in either a service or emergency application comes from the auxiliary reservoir, and all they can do is to equalize.

Q. In case a brake is noticed to be sticking how may you help it to release with the others ?

A. If it is caused by short piston travel it may be remedied by extending the travel, as this will lower the auxiliary pressure on a full application, as brakes are more liable to stick on the rear end of long trains than when near the engine ; this car can be set ahead, also stop any leaks in the brake pipe.

Q. What is usually the trouble with a brake which when applied will sometimes remain applied and at other times release ?

A. A dirty slide valve which sometimes seats properly and at others not ; if it does not seat, auxiliary reservoir pressure leaks to the atmosphere through the exhaust port thus releasing the brake.

Q. (a) What defect will cause a constant blow at the exhaust port of a New York Quick Action Triple Valve? (b) What effect will it have when brake is applied ?

A. (a) A leaky slide valve. (b) It will reduce the auxiliary pressure and release the brake.

Q. What defect would cause a blow at the side cap vent ports of a New York Triple Valve?

A. The brake cylinder check valve, the emergency, or vent valve leaking.

Q. How may the defective valve be located without taking the valve apart ?

A. The brake cylinder check valve leaking can only cause a blow while the brake is ap-

plied, as at other times there is no pressure in the cylinder. A leaky emergency valve, or vent valve can leak whether the brake is applied or released. To distinguish one from the other,cut the brake out. If the vent valve is leaking it will cause a reduction of brake pipe pressure and apply the brake ; if the brake does not apply cut it in again and then have it applied ; if the emergency valve is leaking it will reduce the auxiliary pressure and generally release the brake.

Q. What effect would a leaky gasket between the triple valve and auxiliary reservoir on freight, or the brake cylinder on passenger, or a leaky tube in a freight auxiliary have on the brake ?

A. It would cause a blow at the exhaust port of the triple valve when brake was released, and by reducing auxiliary reservoir pressure would release a partly applied brake.

Q. Why would it not release a fully applied brake ?

A. Because when the brake is fully applied the auxiliary and brake cylinder pressures are equal and one pressure could not leak into the other.

Q. How may poor brakes be detected at the foot of a grade ?

A. By feeling of the wheels.

Q. Would you expect to find the wheels all the same temperature ?

A. No, the heavier cars having more braking power than the lighter ones will naturally have the warmest wheels.

Q. If all brakes applied in the test at the top of a grade what would cause some cars to have cold wheels at the foot of the grade ?

A. It may be caused by low braking power, poor packing leathers in brake cylinders, poor retaining valves or dirty feed ports in the triple valves.

Q. How could dirty feed ports cause cold wheels ?

A. In descending heavy grades there are but a few seconds in which to re-charge the auxiliary reservoirs, consequently they are never fully recharged after the first application that is made, therefore, they do not do their share of the holding.

Q. When not necessary to use all retainers, how should they be used ?

A. At the head end, if the grade is short, otherwise change them occasionally and use every other one so as not to overheat any wheels.

Q. If a train was stopped on a grade can the air brake be depended on to hold it ?

A. No, the air brake should be released and hand brakes applied to hold the train.

Q. In testing brakes, why should they always be applied and released from the engine ?

A. It may happen that a Brakeman could open an angle cock on the rear end and apply the brakes, and the Engineer release them, but that the Engineer could not apply them from the engine, due to a hose lining getting loose

and rolling up, closing the hose when the air was flowing in the opposite direction.

Q. Why should the hose always be uncoupled by hand ?

A. If allowed to pull apart it springs the couplings so they do not make tight joints ; it may tear the hose off or break the pipe ; it also strains the rubber so it soaks in moisture which soon rots the hose ; it also freezes in cold weather, making the hose rigid, which causes excessive leakage besides being hard to couple.

Q. Why are the couplings for the air signal hose made smaller than those on the air brake hose ?

A. So they can not be coupled easily together. The signal hose coupling is usually painted red so as to further distinguish it from the air brake coupling.

Q. What could cause a bad blow at the exhaust port of a Westinghouse, or the side cap of the New York Triple Valve and also prevent the other brakes releasing after an emergency application ?

A. The emergency valve of the Westinghouse, or the vent valve of a New York Triple Valve stuck open.

Q. How may you stop it and get all brakes released ?

A. If jarring around the triple valve did not stop it, would cut the brake out, bleed the auxiliary reservoir and then cut it in quickly ; if this did not stop it, would cut it out, bleed the reservoir of all air and card the triple for repairs.

Q. If on a high speed brake train it became necessary to change engines for one not so equipped what should be done ?

A. Before cutting off, the high speed engine should reduce the brake pipe pressure to 60 pounds, or the reduction may be made by trainmen opening an angle cock slowly until the reducing valves under the cars cease to blow.

Q. Can a car equipped with the high speed brake be placed in a train not so equipped ?

A. Yes, it would make no difference.

Q. If a car not equipped with the high speed brake was attached to a high speed brake train, what precaution should be taken ?

A. A safety valve provided for the purpose should be screwed into the oil plug hole of the brake cylinder head.

Q. What is necessary to make a high speed brake on a car already equipped with the quick action brake ?

A. The addition of an automatic reducing valve, and applying heavy brake beams, rods and levers.

Q. What pressure is carried in the brake pipe and auxiliary reservoirs with the high speed brake ?

A. 110 pounds.

Q. At what pressure will the auxiliary reservoirs and brake cylinders equalize at in an emergency application when using 110 pounds pressure ?

A. About 85 pounds.

Q. What reduces it to 60 pounds, the safe limit for slow speeds ?

A. The automatic pressure reducing valve if a Westinghouse, or the compensating valve if a New York. For description of see pages 115 to 118.

Q. What may cause the reducing valve to fail to properly reduce the brake cylinder pressure and thus slide wheels ?

A. The vent port in the bottom of the spring box in a Westinghouse reducing valve being stopped up, usually frozen over by drippings from steam heat traps.

Q. Is there a vent port in the bottom of the New York Compensating Valve ?

A. No.

Air Signal Code.

Two (2) Blasts of the air signal whistle when train is **standing** is the signal to start.

Two (2) Blasts of the air signal whistle when train is **running** is the signal to stop at once.

Three (3) Blasts of the air signal whistle when the train is **standing** is the signal to back the train.

Three (3) Blasts of the air signal whistle when the train is **running** is the signal to stop at the next station.

Four (4) Blasts of the air signal whistle when the train is **standing** is the signal to apply or release air brakes.

Four (4) Blasts of the air signal whistle when the train is **running** is the signal to reduce speed.

Five (5) Blasts of the air signal whistle when the train is **standing** is the signal to call in the flagman.

Five (5) Blasts of the air signal whistle when the train is **running** is the signal to increase speed.

When one blast of the air signal whistle is heard while train is running, the enginemen must immediately ascertain if the train is parted.

Table Showing Rate of Speed Required Per Mile to Equal a Given Number of Miles Per Hour.

Time Per Mile.	Miles Per Hour.	Time Per Mile.	Mile Per Hour
0 min. 36 sec.	100.00	1 min. 4 sec.	56.25
0 " 37 "	9730	1 " 5 "	55.38
0 " 38 "	94.73	1 " 6 "	54.55
0 " 39 "	92.31	1 " 7 "	53.73
0 " 40 "	90.00	1 " 8 "	52.94
0 " 41 "	87.80	1 " 9 "	52.17
0 " 42 "	85.71	1 " 10 "	51.43
0 " 43 "	83.72	1 " 11 "	50.70
0 " 44 "	81.82	1 " 12 "	50.00
0 " 45 "	80.00	1 " 13 "	49.31
0 " 46 "	78.36	1 " 14 "	48.65
0 " 47 "	76.59	1 " 15 "	48.00
0 " 48 "	75.00	1 " 16 "	47.37
0 " 49 "	73.47	1 " 17 "	46.74
0 " 50 "	72.00	1 " 18 "	46.15
0 " 51 "	70.59	1 " 19 "	45.57
0 " 52 "	69.23	1 " 20 "	45.00
0 " 53 "	67.92	1 " 21 "	44.44
0 " 54 "	66.66	1 " 22 "	43.90
0 " 55 "	65.45	1 " 23 "	43.37
0 " 56 "	64.29	1 " 24 "	42.86
0 " 57 "	63.16	1 " 25 "	42.35
0 " 58 "	62.07	1 " 26 "	41.86
0 " 59 "	61.02	1 " 27 "	41.38
1 " 0 "	60.00	1 " 28 "	40.91
1 " 1 "	59.02	1 " 29 "	40.45
1 " 2 "	58.06	1 " 30 "	40.00
1 " 3 "	57.14	1 " 31 "	39.56
		1 " 32 "	39.13

Time Per Mile.	Miles Per Hour.	Time Per Mile.	Miles Per Hour
1 min. 34 sec.	38.29	2 min. 48 sec.	21.43
1 " 36 "	37.50	2 " 50 "	21.17
1 " 38 "	36.73	2 " 52 "	20.93
1 " 40 "	36.00	2 " 54 "	20.69
1 " 42 "	35.29	2 " 56 "	20.45
1 " 44 "	34.61	2 " 58 "	20.22
1 " 46 "	33.96	3 " 0 "	20.00
1 " 48 "	33.33	3 " 2 "	19.78
1 " 50 "	32.73	3 " 4 "	19.56
1 " 52 "	32.14	3 " 6 "	19.35
1 " 54 "	31.58	3 " 8 "	19.15
1 " 56 "	31.03	3 " 10 "	18.95
1 " 58 "	30.51	3 " 12 "	18.75
2 " 0 "	30.00	3 " 14 "	18.55
2 " 2 "	29.50	3 " 16 "	18.37
2 " 4 "	29.03	3 " 18 "	18.18
2 " 6 "	28.57	3 " 20 "	18.00
2 " 8 "	28.12	3 " 22 "	17.82
2 " 10 "	27.69	2 " 24 "	17.64
2 " 12 "	27.27	3 " 26 "	17.48
2 " 14 "	26.87	3 " 28 "	17.31
2 " 16 "	26.47	3 " 30 "	17.14
2 " 18 "	26.09	3 " 32 "	16.98
2 " 20 "	25.71	3 " 34 "	16.82
2 " 22 "	25.35	3 " 36 "	16.66
2 " 24 "	25.00	3 " 38 "	16.51
2 " 26 "	24.66	3 " 40 "	16.36
2 " 28 "	24.32	3 " 42 "	16.22
2 " 30 "	24.00	3 " 44 "	16.07
2 " 32 "	23.68	3 " 46 "	15.93
2 " 34 "	23.38	3 " 48 "	15.79
2 " 36 "	23.08	3 " 50 "	15.65
2 " 38 "	22.78	3 " 52 "	15.51
2 " 40 "	22.50	3 " 54 "	15.38
2 " 42 "	22.22	3 " 56 "	15.25
2 " 44 "	21.95	3 " 58 "	15.12
2 " 46 "	21.69	4 " 0 "	15.00

Index.

NEW YORK AIR BRAKE.

TRAINMEN.

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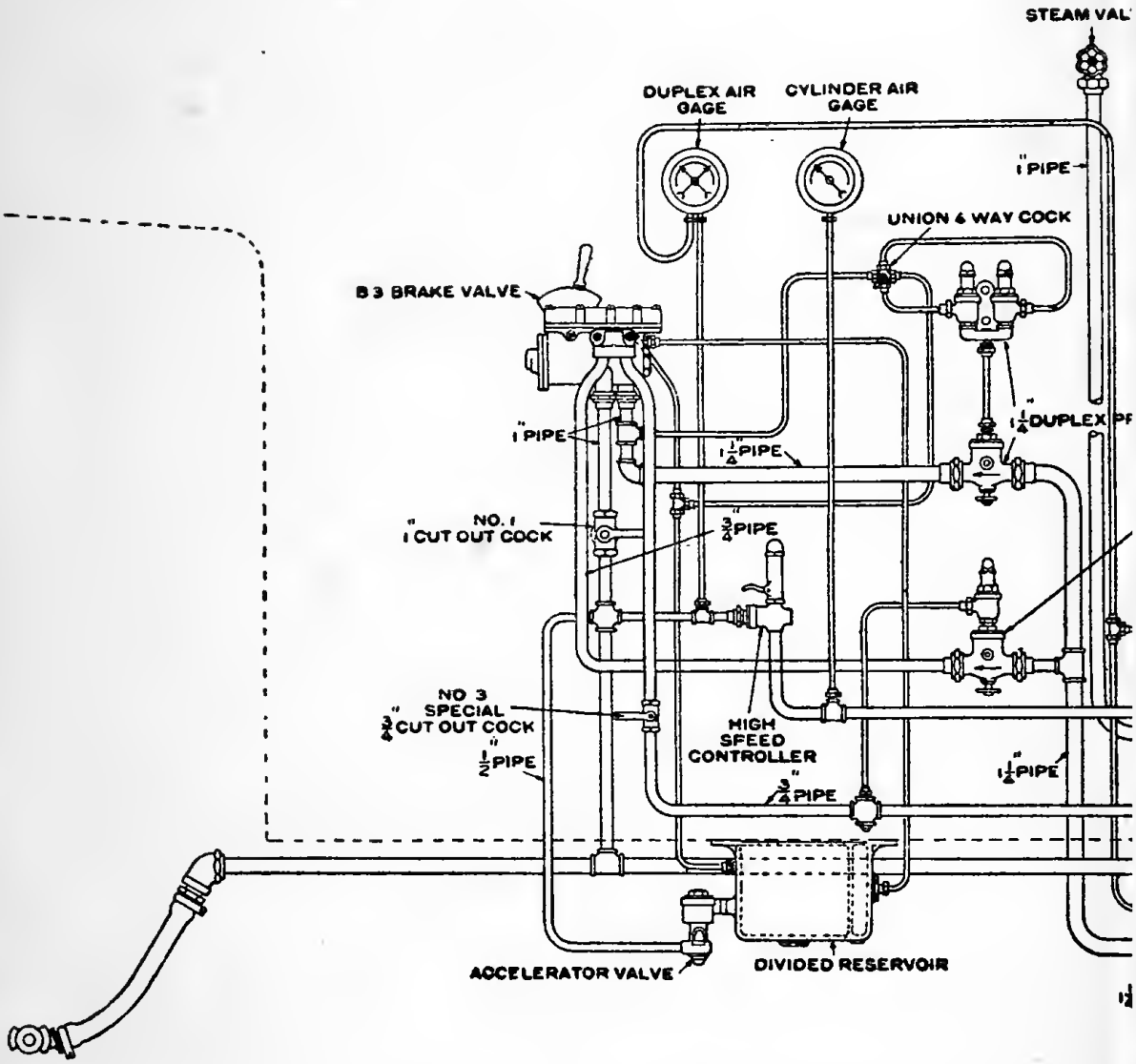
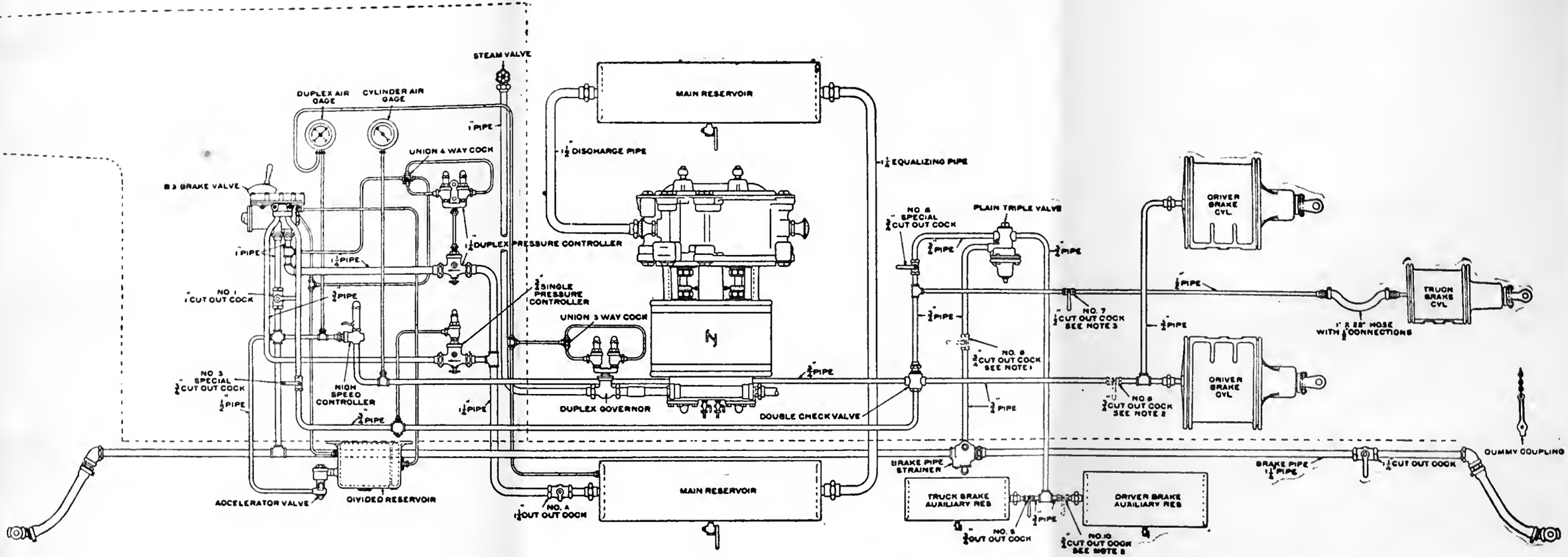
PORT JERVIS, N. Y.---1908.



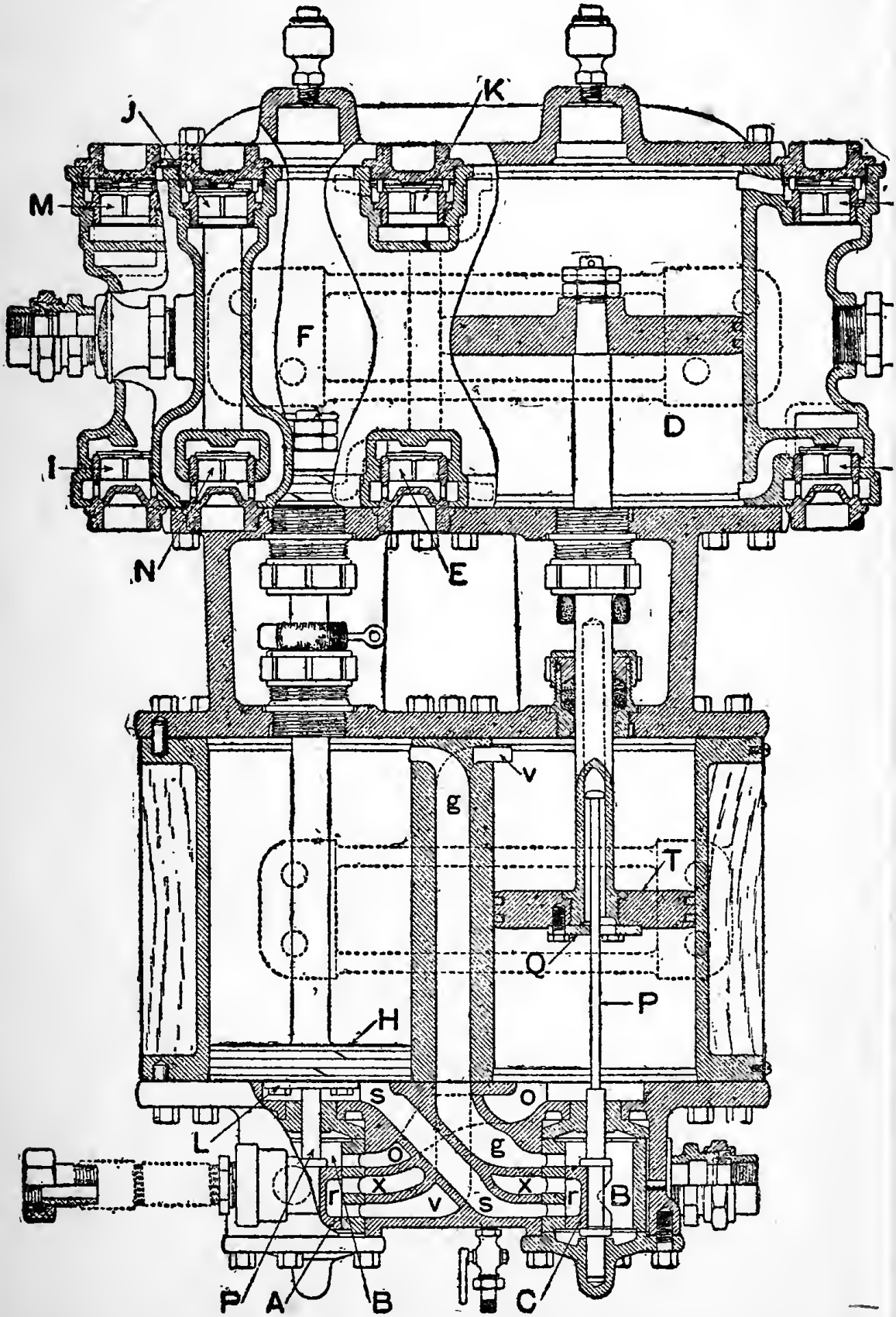
Piping Diagram. Sch



Piping Diagram. Schedule B3-HS For use in Passenger Service. (High Speed Brake.)

Plate 1.

Low Pressure Piston Moving Upward. High Pressure Piston at Rest.



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Low Pressure Piston Moving Upward. High Pressure Piston at Rest.

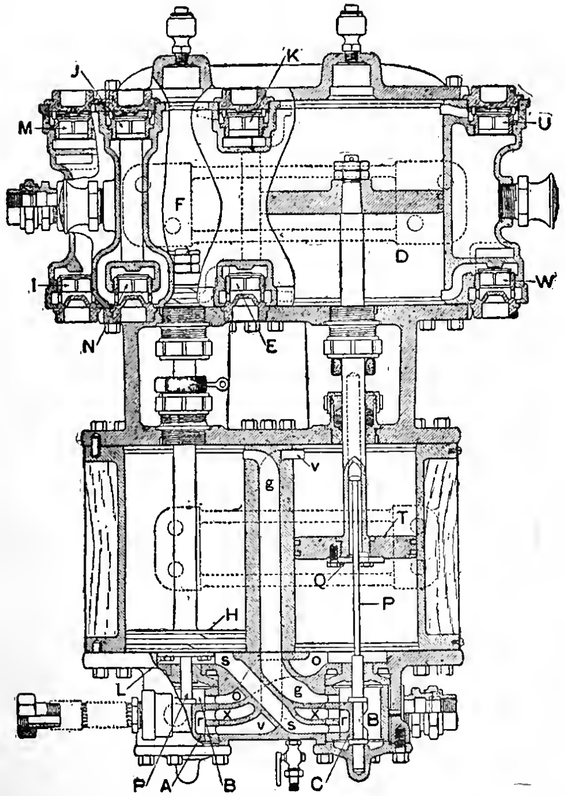


Plate 2.

High Pressure Piston Moving Upward. Low Pressure Piston at Rest.

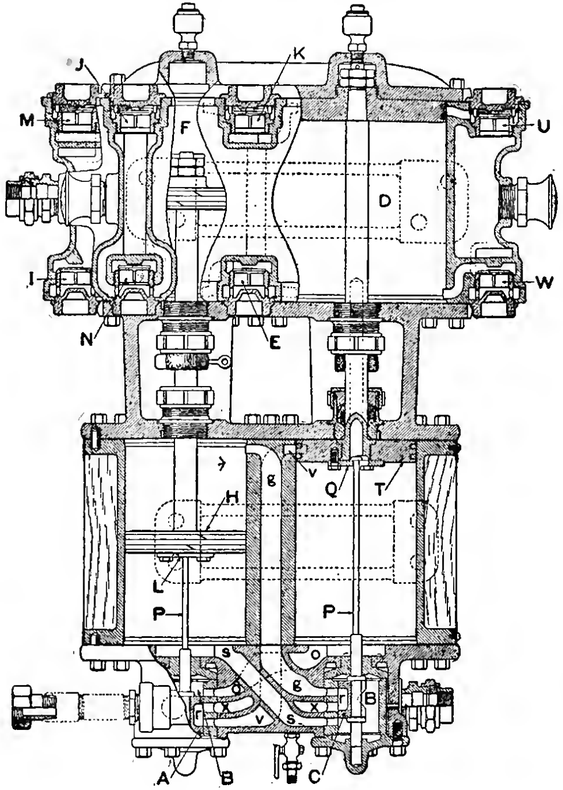


Plate 3.

Low Pressure Piston Moving Downward. High Pressure Piston at Rest.

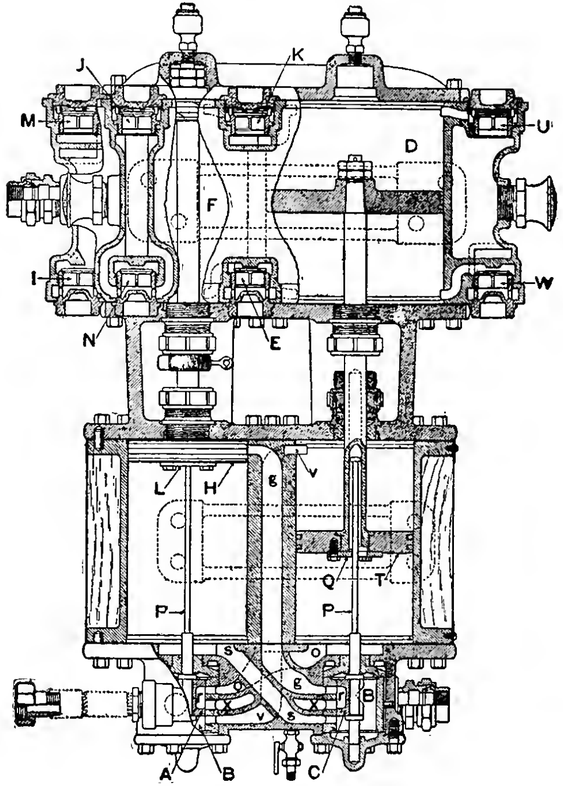
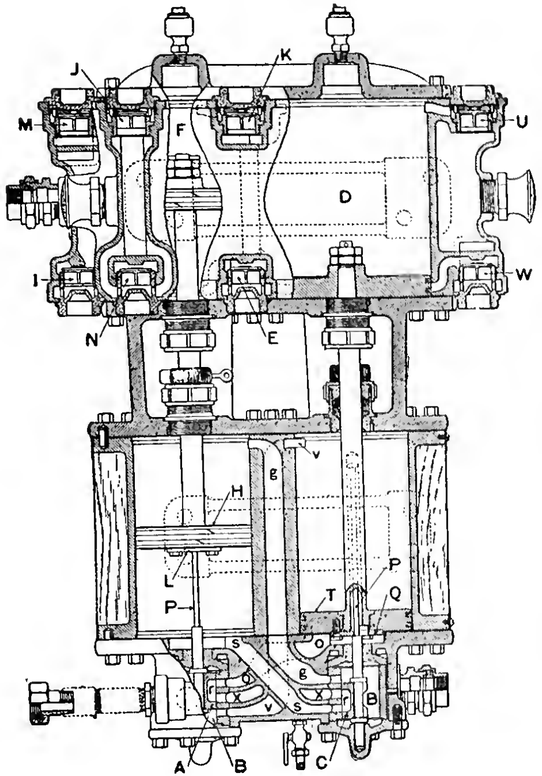


Plate 4.

High Pressure Piston Moving Downward. Low Pressure Piston at Rest.



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